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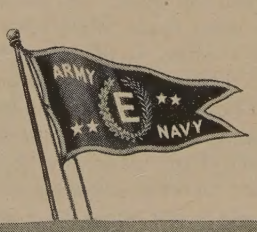

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Nature in Print

By HOWARD ZAHNISER

"What to do with our land is fully as important to the city man as it is to the farmer," wrote Arthur P. Chew in the U. S. Department of Agriculture's Yearbook for 1940. After pointing out the serious possibilities of forgetting "the basic fact that all occupations rest on the land," Mr. Chew commented as follows:

"Superficially the urban interest in our land concerns mainly the food supply and the availability of suitable areas for forests, wildlife refuges, and parks. For these requirements our land supply is ample. . . . In another sense, however, we have an acute land shortage. Millions of people who want land cannot get it. The paradox is a problem of national concern. In short, we have pressure of population on the land supply. City people feel it equally with rural people."

There have been national concerns that have seemed much more urgent since Mr. Chew wrote these words. Lands for crops and for military establishments have represented the needs that have been uppermost. For a time the broad needs for a better thought-out use of our lands have in general been disregarded. Yet these needs are, from a long-time point of view, just as important as they were, and it is perhaps none too soon to begin again to mobilize our ideas and plans for a renewed peacetime effort to make an intelligent and therefore effective, adequate, and conserving use of our land resources.

It has thus seemed opportune to have our thinking turned in this direction by the publication of Edward H. Graham's *Natural Principles of Land Use*. In my own case it has been all the more timely as following my personal reading of Paul H. Landis's thought-provoking textbook *Population Problems: A Cultural Interpretation*. Dr. Landis had written his book for students and readers of sociology and had not been specifically concerned with the relationship of recreational and wilderness areas to population pressures in urban areas. Perhaps, still, this problem affects so few of the mass of urban peoples that it does not yet concern sociologists too deeply. Yet I felt better able to think of such problems because of having read Dr. Landis's book, with its organization of data on population and population trends, its description of human behavior, and its surveys of the distribution of population by regions in this country and the problems of migration. Although hardly to be described as "Nature in print," this volume, and similar works by specialists in other fields, might more often than they have be added to our reading. At least, it has been curious thus to reflect on how a reading of *Population Problems* enhanced my reading of Dr. Graham's highly significant volume.

I would strongly recommend *Natural Principles of Land Use* for the library of any reader who wishes to have a thoughtful interest in any aspect of conservation—whether that library be large or merely a few books on a shelf. And if any such prospective reader has no such collection of books I would certainly recommend this volume as a beginning. To me, after some years of attention to the literature of conservation, Dr. Graham's work seems a prize possession primarily because it is rich in the definition of new concepts and new terms that have been added to our means of thinking and talking about conservation. Then, too, it is a comprehensive work, hence a good book for a beginning, or a new beginning. Furthermore, the writing is clear and alive, the book is effectively and abundantly illustrated, and the 29-page bibliography is unusually helpful.

Essentially Dr. Graham's work is what might be called a manifesto and guide for a new kind of technician, a sort of ecologist that Dr. Graham calls "the land-management biologist." The task of this specialist in inter-relations, says Dr. Graham, is "(1) to increase populations of species that are esteemed for their economic, recreational, esthetic, or other values, (2) to decrease populations of those species that are harmful to useful plants and animals or otherwise injurious, and (3) to maintain a reasonable balance between communities of living things and land-use practices."

Thus this technician's task may be said to be that of doing effectively the things that we who have a general interest in conservation would like to see done. Hence, the value to us of this clearly, simply written textbook (and it is so being used in a course on "Land Management Ecology" that Dr. Graham teaches in the Graduate School of the U. S. Department of Agriculture). Dr. Graham entitles his introduction appropriately "A Fresh Horizon," then discusses living things and the land, the ceaseless changes in and of living things, the importance of studies of the land. He writes chapters on farms, forests, range, wildlife, waters, exotic things, "Control," and concludes with a discussion of "The Land and Human Welfare." The usefulness of such discussions to students and general readers is apparent, and I suspect that in its approach to the problems it is concerned with this volume will have considerable influence on Dr. Graham's colleagues.

"Conservation," concludes Dr. Graham, "is more than wise use and preservation of natural resources—mineral, soil and water, plant and animal, human. It may well be the foundation of a new social philosophy. Our public land policies, antitrust regulations, tariffs, and related laws were developed around the exploitation of natural resources and they helped materially to promote our present economy. Is it not reasonable to suppose, then, that laws and regulations which promote the conservation of resources will help to build a new attitude toward the environment in which we live? And from this may develop a way of life as different from the prevailing one as that is different from cultures of the past."

Thus in its broad visions, as well as in its particular expositions, *Natural Principles of Land Use* is estimable, and it can indeed be wholeheartedly recommended as a possession.

Certainly fascinating has been the reading of C. M. Goethe's *Sierran Cabin . . . From Skyscraper* in this connection, for Mr. Goethe's highly individualistic accounts of his excursions from Sacramento, California, not only to a Sierran cabin but also to long hikings are striking combinations of his interests in outdoor Nature and in eugenics. Mr. Goethe seems equally interested in the fourth child of good families and in the appreciation of Nature as the source of wisdom. Dr. Landis with his population problems would be as interested in what Mr. Goethe has to say about birth rates as Dr. Graham would be in his descriptions of the life zones of California and the other ecological observations he has made. And any reader

To Emily Dickinson

By W. F. JENKINS

Runaway child from Castle Vogue, who unattended strayed
Across the sunny flower fields and fair acquaintance made
With all the age-long timid folk, who told you everything
That mortals almost had forgot through years of reasoning.

It must have been a goodly fate your messages were sealed,
For never else for what you were could you have been revealed.
And no one ever changed a thought or rhetorized a word;
Your confidant the bumble bee, hail-fellow to the bird.

will find this book delightful for its Nature lore, its anecdotes of mountain men and women, especially those of pioneers, and the intriguing personality of the writer that is apparent in his discursiveness as well as in the "singleness" of his dual purpose. There is no doubt in the mind of the reader of *Sierran Cabin . . . From Skyscraper* that population problems and conservation are interrelated, and no doubt either that he has been entertained in a unique way.

Natural Principles of Land Use. By Edward H. Graham. London, New York, and Toronto: Oxford University Press. 1944. 274 pp., with 64 photographs on 32 plates, 8 text figures, annotated bibliography, list of scientific names, and index. $3.50.

Population Problems: A Cultural Interpretation. By Paul H. Landis. New York: American Book Company. 1943. 500 pp., with numerous text figures, selected references, and indexes.

Sierran Cabin . . . From Skyscraper: A Tale of the Sierran Piedmont. San Francisco: The Keystone Press, 114 Sansome Street. 1943. 185 pp., with 46 photographs, 4 drawings, list of thirty-three joys, and index. $1.25.

Prairie Chicken

The Prairie Chicken in Missouri. By Charles W. Schwartz. Jefferson City, Missouri. 1944. State of Missouri Conservation Commission. 176 pages, 9 by 12 inches. 85 photographic reproductions; full color frontispiece. $3.50.

This is an outstanding bird book, based upon three years of study of the prairie chicken by a biologist-author-photographer. Readers of *Nature Magazine* were treated to a sort of preview of the book in May of this year with the publication of "Prairie Chicken Panorama" in the rotogravure section. This, however, was like the alluring previews in the movies, which suggest the enticements of the cinema feature to come. Anyone who was interested in the magazine feature will desire the book itself.

The life of the prairie chicken is a fascinating story. The drama of its courtship is perhaps the most fascinating among birds. This bird, so typically American, once was heard booming in spring throughout the prairies of Missouri, and even on some open ridges in the Ozarks. Today some thirteen thousand birds remain in a restricted area. In a foreword to the book J. N. (Ding) Darling says: "That the prairie chicken is now to be seen at all is one of the miracles of Nature's persistence and a tribute to those who believe that by wise management and understanding we can retain both the beauties of Nature and the comforts of civilization." This is a book to be read and treasured, both for its record and its pictures.

The public sale price of the book, the edition of which is limited to 2000 copies, is five dollars. However, since the exigencies of press deadlines made it impossible to announce the book, before publication, in *Nature Magazine*, fifty copies have been reserved for our readers at the pre-publication sale price of $3.50. These will be distributed in the order that requests, with remittance, are received by the Conservation Commission, State of Missouri, Jefferson City, Missouri. You must mention *Nature Magazine* when ordering. This offer is good until November 10, 1944.

Whence the Names

A Source-Book of Biological Names and Terms. By Edmund C. Jaeger. Springfield, Illinois. 1944. Charles C. Thomas. 256 pages. $3.50.

Within the covers of this book are listed some 12,000 elements from which scientific biological names and terms are made. With them are given their Greek, Latin, or other origins and their concise meanings, together with numerous examples of their use in scientific nomenclature. Also are included many prefixes and suffixes that are puzzling to the student. Thus is provided a means of knowing the literal meaning of the words one encounters in scientific literature. Introductory pages describe how words are built and the types of names considered. Foolishly many people are awed by scientific names, but once one knows how they are put together they become fascinating.

Garden Pests

Pest Control in the Home Garden. By Louis Pyenson. New York. 1944. The Macmillan Company. 190 pages. Illustrated. $2.00.

Millions of Americans who had little idea of the inroads of garden pests have come to have a real appreciation of the problem in the Victory Garden. They have discovered Mexican bean beetles materializing out of the nowhere, and other voracious insects, apparently tuned in on the bug underground, turning up suddenly to go to work on the garden's crops. In this simple and practical book the author provides a useful guide to pest control. The pictures are a great aid to identification of the specific pests.

Ancient Man

Ancient Man in North America. By H. M. Worthington. Denver. 1944. The Colorado Museum of Natural History. 2nd and revised edition. 90 pages. Illustrated. 35 cents.

This excellent booklet was so well received that a new edition was almost mandatory on the Colorado Museum. Also recent discoveries have been such as to make revision necessary. This is an extremely interesting and valuable discussion of our knowledge of ancient man in North America.

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Nature and Fitness

Several times we have quoted the editorial comment with which W. Scott Lewis prefaces each issue of his little mimeographed *Mineral Bulletin*. His most recent wise words have to do with the relationship between physical and mental fitness for military service.

"During World War I 3 percent of all the young men examined for the draft were rejected because of nervous and mental disorders. During World War II 10 percent are found to be unfit because of these disorders, and 20.4 percent of all rejections are for neuropsychiatric reasons, seven times the rate for World War I.

"We have not seen any discussion of the above figures, but to us they indicate a far greater danger than most of the things that will be 'viewed with alarm' by the professional politicians between now and the first Tuesday in November. No nation can remain strong if it allows such a condition to continue, and it would seem that every effort should be made to determine the cause of the startling increase and to eliminate it promptly.

"We cannot but wonder if there is not a connection between this problem and the condition described by trainers. One says: 'They have forgotten how to walk because it was easier to ride. They don't know how to live out of doors because they have never lived out of doors. Their muscular endurance is trifling because they have never used their muscles.' It is true that strong minds do not always go with strong bodies, but we believe that the type of life that develops strong bodies will also prevent many nervous disorders.

"Some fortunate youngsters have parents who love the out-of-doors. They go on camping trips and take long hikes. They are keenly interested in Nature. They study the birds and the trees. They collect insects and minerals. They observe the clouds by day and the stars at night. Their eyes are bright, their muscles are firm and their skins are brown and healthy. Best of all, their minds are alert and as far as they are concerned 'psychopathic' is merely one of the words that helps to sell dictionaires.

"Other boys know nothing of Nature. Life is pretty much of a bore as they are mostly interested in movies, the more exciting the better. They demand mental thrills, and these must become stronger and stronger as the years pass. When they become young men their chief exercise is dancing, and this means late hours and too often it ends with liquor and types of excitement that can scarcely be considered of either mental or spiritual value. Their eyes are dull and their skin is pallid. Their muscles are flabby and their nerves are shot. No wonder the army rejects them. They are not an asset to their country."

No Mother's Pies for those G.I.'s—But—

NATURALLY, you mothers and wives and sisters would like to be over there seeing to it that your boys have that good home cooking. For it's a long jump from K rations to strawberry shortcake.

But, though you can't cook for them, you can do this: you can help see to it that the food they get is in perfect condition! How? By doing everything you possibly can to save paper and to aid your storekeeper in saving paper.

For it's paper and paperboard, tons and tons of it, which protect our food shipments to the Army overseas. From paperboard containers so strong they can be dumped overboard from a landing craft and floated ashore, to the thin moistureproof paper used to keep the individual food item moistureproof — paper is doing a tremendous job for the Services of Supply all around the world. And of course, we still need tons and tons of paper for essential civilian use.

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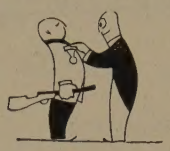
Contents Noted

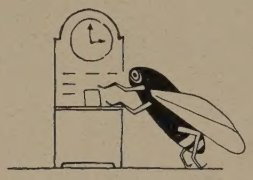
"Mother Nature is the only woman who can keep secrets!" writes a reader. We had never thought of Nature in precisely that way, possibly because we have never liked the term "Mother Nature," and never use it in these pages. Yet it is true that Nature has kept her secrets well. She has yielded them reluctantly and piecemeal to prying man. Many she still guards tantalizingly, thus adding ever to her fascination, surprising us with the many sides to her character. Her friendship is hard-won, never complete. She is coy but intelligently so, knowing that to be truly loved and forever admired she must retain mystery; *must* keep secrets. As Seneca said of Nature: "We imagine we are initiated into her mysteries when we are as yet but hanging around her outer courts."

One of the Nature secrets that man has ferreted out is reported by the Better Vision Institute. Many animals that spend much time in the sun have been provided with built-in sunglasses. They have a yellowish network of capillaries in front of the eye's retina; yellow corneas and yellow lenses in their eyes. The prairie dog that basks in the bright sun of the level country has a highly-colored protective filter in his visual equipment. Thus the blue rays are filtered out and the amount of light reduced. Human beings, however, belong to the shade-loving animals and have to have sunglasses, which, the better vision folks add, should not be cheap ones. Nature provides only the best, and man should do likewise.

According to a story published in the house organ of the Youngstown Sheet and Tube Company, and republished with pictures in *The Ohio Conservation Bulletin*, two employes of that company won "the honor of shooting the first wolverine in Ohio." They were out at night with their 'coon dog, which treed an animal that kept jumping to the ground every time the flashlight was turned on it. So they shot it, mystified. Investigating, they found it something they had never seen before, feared they had killed illegal game, had it identified the next day as a wolverine, and finally turned it over to a museum. There was nothing illegal in this shooting, and we would not mention it were it not for the fact that we shall never be able to understand the viewpoint that makes it an "honor" to shoot the first—or the last—of any species of bird or mammal, Hitler excepted.



Blowflies are working for the government at the Bureau of Plant Industry Station at Beltsville, Maryland. In some parts of the country where commercial production of onion seed is carried on these insects are the principal pollinizers. So government scientists, breeding onions and seeking an abundant setting of seed, imprison blowflies in mosquito netting cages secured over blossoming onion heads. The insects work overtime, dying in service in a few days but leaving well-seeded heads. Blowflies seem to be Jekyll and Hydes because they have the nasty habit of breeding in nestling birds, killing them. Our scouts also advise us that the larvae of blowflies are—or were—used in surgery to cleanse deep wounds and diseased bone. We have not, however, quite made up our minds to like blowflies, and hope we do not have any deep wounds for them to cleanse.



A new hero for the youngsters—and, just between ourselves, we think highly of him also—will be Dr. H. C. Sherman of Columbia University. Before he struck off the shackles of government service he was head of the Bureau of Human Nutrition and Home Economics of the U. S. Department of Agriculture. In that capacity he may have had to be careful of what he said lest he offend the National Association of Spinach Propagators, but now he comes boldly forth against spinach and beet greens, as well as other greens of the Goosefoot Family. They have, he warns, an undesirably high content of oxalic acid, which our technical dictionary describes as "poisonous crystals that are transparent and colorless," which sounds inimical to human interiors. Dr. Sherman urges broccoli, loose-leaf cabbage and lettuce, collards, turnip tops, mustard greens and kale. In fact, he is strong for kale, important in vitamin A and calcium, and a crop you can seed in the fall and that often survives winter frosts. When we think of the tons of spinach we have eaten because "it is good for you" we feel hopelessly put upon.

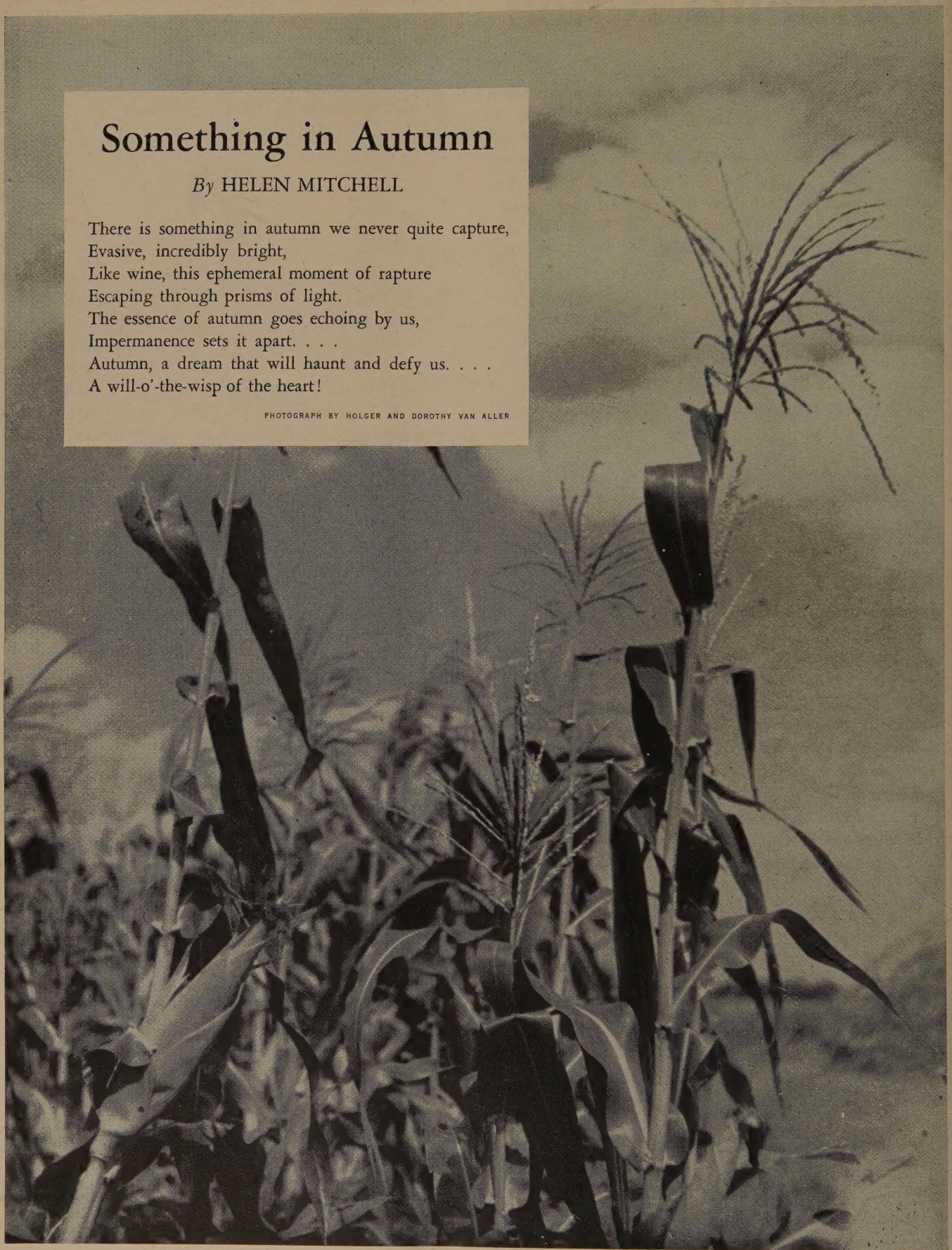
R. W. W.

Something in Autumn

By HELEN MITCHELL

There is something in autumn we never quite capture,
Evasive, incredibly bright,
Like wine, this ephemeral moment of rapture
Escaping through prisms of light.
The essence of autumn goes echoing by us,
Impermanence sets it apart. . . .
Autumn, a dream that will haunt and defy us. . . .
A will-o'-the-wisp of the heart!

PHOTOGRAPH BY HOLGER AND DOROTHY VAN ALLER



Desert Discoveries

Photographs by the Author

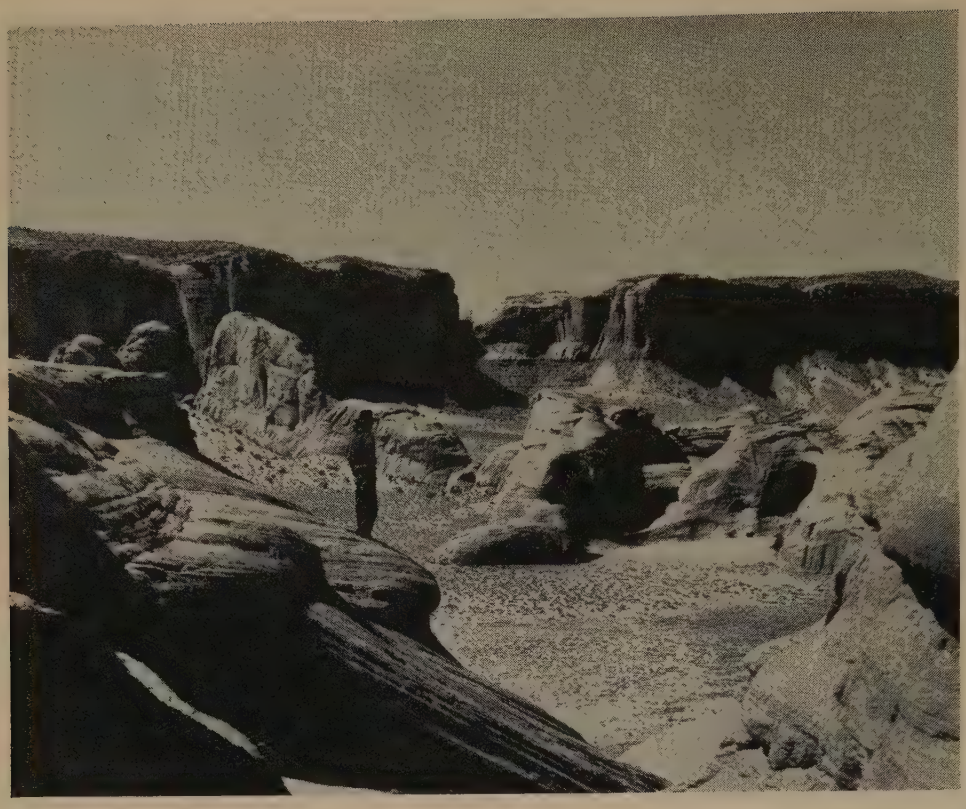
By JOHN LINDSEY BLACKFORD

LAND of Surprises—that is the desert. Deep in the cool of palm-thatched canyons, high atop backs of sheer-walled mesas, there are secrets never suspected. Out on the shimmering rubble of outwash plains, over grassy *cienegas* sweeping away to the hills, discoveries await that deepen our understanding. There may be lodes never located, lost mines never reclaimed, but new strength, new hope, new zest for living are certain when we discover the desert and call it our own.

It may be only the bright wing of a bird, the scuttle to cover of an exotic reptile, but the magic and the mystery of a strange land and stranger wild things are about you, different from anything else you have known; challenging to our imagination.

In early May I trudged across the colorful, drifting, rippled sands of Tsay-Begeh. Cavernous canyons clove red mesa walls in every direction. Precipitous sandstone cliffs thrust up a thousand feet above the dunes and black brush that floored the maze of gigantic corridors. Distantly, through stony gates, rose the fantastic buttes and monolithic figures of Monument Valley, Arizona. I was truly inside Inside-the-Rock—the meaning of the alluring Navajo name. Miles away, across menacing washes and treacherous sand, the road crawled toward Mexican Hat; and near it, in Utah, Goulding's Trading Post was hid below the high wall of Rock Door Mesa. Beyond and westward reached more than a hundred miles of red rock, green juniper, and blue sky of the Western Reservation.

Distantly rose the fantastic buttes and monolithic figures of Monument Valley, Arizona. Left center is the Emperor's Throne, with, to its left, Indian Rock. In the right foreground is one of "The Mittens." It was truly a land of majestic mystery.



Leon, the Navajo guide, looks out over the land his people call Tsay-Begeh, which means Inside-the-Rock. It is a land of cavernous canyons cloven by red mesa walls in every direction.

From the glaring dunes I gained the coolness of cliff shadows; and, swinging my canteen, hastened toward the little dam that, braced across a narrow gorge, stored winter run-off from the mesa top. The Indian Service had built the structure, and the tiny cliff-walled pool hoarded twelve feet of sweet water resting motionless and glassy beneath a light scum of wind-borne pollen. I had come before, and observed nothing unusual: once a transient flock driven by a nomadic Navajo to water at the trough under ghostly, naked, gnarled gray trees beyond; always the massive mesa looming above; and white-petaled shrubs against the wall heavily scenting the air.

But now I halted abruptly. Sprawling in the wet sand at the foot of the high dam were the great, spreading, long-toed tracks of a blue heron! They stalked confidently across this miniature strip of welcoming dampness. How in that infinity of sand and rock had this lordly wader sensed the presence of the diminutive reservoir, a mere pool of water? How could he know, dropping from his dizzy skyways, that here, hidden in the mighty clasp of overshadowing cliffs he should find his element? Except for a few seepages and scattered *tinajas* or potholes in the rock, the life-giving drink could not be found for thirty miles. There was no answer, save that the same hand that guided this lone, migrant spearman under the distant, steely stars had likewise led him here.

Leon, my Navajo friend, paused on the trail one afternoon. "Would you like to see a rock lizard?" he asked.

There was only the bare, vertical wall of the mesa, a large buff-red boulder lying against it, and the desert floor of fine, sugary, dune sand from which to produce this diversion. Unless a reptile could be routed from behind the boulder, it seemed my eyes were not so keen as his. But he merely stooped and picked up a narrow fifteen-inch slab of sandstone leaning against the rock at the very edge of the path where the Indians passed regularly on foot and horseback. A big, dusty lizard kicked up a shower of sand as he dashed off in a speedy sprint along the base of the towering wall and away into the dazzling sunshine. My camera failed to catch up; but he would always be conveniently behind the rock slab, Leon assured me, ready to be demonstrated to visitors.

Only after several such instances of indifference to my photography did the desert stage one of its characteristic surprises. On a trail in the Chiricahuas, where you come from the yucca plains of New Mexico, mount to lofty pine ridges in Arizona, and gaze off into the hazy allurement of Old Mexico, I found the western black scales. These small, amiable fellows were as regardless of the camera's glassy stare as they were intent upon soaking up the flood of spring sunshine. I was in haste to photograph the fantastic rock formations of the canyon while morning shadows still lay long among their towers by the desert's rim, yet the scaled lizards obliged with distinctive pictures. In record time I persuaded three of them to pose together.

It was on another day in Tsay-Begeh that Leon led me to the top of one of the great red mesas rising like an island of stone from the tawny desert floor. He knew the one spot where perpendicular walls slanted down into a slope that we could scale steeply. His sinewy figure in tight "levis" and jacket, topped by long, coiled, black hair and uncreased ten-gallon sombrero, moved easily ahead, up sharp pitches in the rock that leaped off quickly to the sand several hundred feet below. Over the shoulder of the mesa we made a first discovery, a little dell where thin, green grasses grew tall and shrubs bowered the hidden cove in the barren rock. Then up across the wind-

Some curious, gazelle-like creatures spring across the face of the rock in Tsay-Begeh. One comes to expect rock writings in the desert, yet always that magic land adds a new discovery.

smoothed stone, and suddenly — water! In deep *tinajas* held high to the sky on the back of the mesa there was water, countless gallons of it. It lay limpidly in dark, emerald pools sunk deep in the impervious sandstone—in "tanks" that were achievements of chemical weathering and local decay. One of the pools was fifteen feet long, and the bottom obscure in depths far below the rim. To those who held the amazing secret, here was water on the roof of the desert!

Now as we mounted the last gentle slant to this forgotten world of the sky the far rusty rim of the desert shimmered above it. Mesa rose beyond mesa, canyon beyond canyon, and off to where the unbroken desert subsided into an illimitable basin, heat waves danced, wrinkling the mysterious distances.

Above was intense, unfathomable blue. Soon a cool breeze touched our faces, carrying away the heat from the rock. Boots gripped the cross-bedded stone firmly, so that as we moved over the irregular tableland our eyes still could cling to superb canyons and enchanting distances. And then suddenly we adventured upon another small paradise of the sky. In a stone-carved dale, two junipers, roots and crowns interlocked, had gathered and hoarded a store of wind-blown sand and fine rock debris. On such meager earth they had survived while their clutch on the stone strengthened, and the high-level winds twisted and fashioned dwarfish trunks. Their scaled foliage was the unimaginably vital, deep green of the "cedars" of Tsay-Begeh; elsewhere I had seen no other desert junipers with leafage so verdant.

It was almost a sacrilege to tramp down the waving grasses of this miniature oasis, I was thinking, when abruptly our presence disturbed the hermit spirit of its tiny grove. Soundlessly a rare Arizona spotted owl glided out from the dense crown of the junipers. Hardly two yards away, when he departed his retreat in their ancient branches, he spiraled steeply down on motionless, silent pinions into the boundless canyon depths below. How our feet demanded urging to leave this latest discovery in the desert, this high, dreamy, idyllic little heaven under the blue!

Down on the flinty desert floor we passed along a sheer, red sandstone cliff. Solidified dune sands of the mesa, cleaving flatly away, had exposed a large section of the smooth, upright bedding planes of the plateau formation.

"There, pictures-on-rock," pointed Leon. His easy gesture transported us from the present moments of dazzling sun and tiring sand to the excitement of a desert chase long ago. Chipped out in profile on the sheltered surface of the wall, curious, gazelle-like creatures sprang across the flat face of the rock. In their efforts to attain perspective, the forgotten artists had often spaced the four legs of an "antelope" evenly along its entire underside. Yet primitive art alone could not account for certain other strange characteristics of these petroglyphs. Each figure was distinctly executed. Unmistakably the horns of each beast were intended, as they had been portrayed, to swing far over the back in sweeping curves. Obviously those prehistoric hunters had not pictured our native pronghorns; neither were the slender neck and the head goat-like. "Bighorns" they might have been, but there was little curvature to indicate the spiraled headgear of mature mountain sheep. Rather they resembled the gazelles of another continent, so that the mystery of their game enhanced the mystery and fascination that surrounded those ancient artists. Rock writings we have come to expect in the desert; yet always that magic land adds a new discovery and

The long-eared kit fox comes to the bait set for him in Death Valley, and the trip cord of the camera sets off a blinding flash to record his visit.

a new wonder that we have never forseen.

Where the Hassayampa curves its bordering mesquite and cottonwoods between torrid saguaro and cholla-studded slopes in central Arizona, the desert held another surprise. It was only mid-April, yet I could span the stream in one leap; for the "river" was now no more than a shallow watercourse a pace or two across, meadering over its wide, sandy wash between walls of new green two hundred yards apart. Above, there had been no surface water at all flowing in the river's broad bed. Not far below, the temporary stream would vanish again beneath the warm, thirsty gravel. Still the verdant *álamos,* that so ardently followed the Hassayampa's banks, were a bower of leafage, a reviving refuge from the sun, and a paradise for the birds.

As I broke through arrowweeds on a dry gravel bar close under the cool poplars, a large inhabitant of the shady fringes flapped away and was lost to sight in those lofty cottonwood crowns. It might have been a water bird—there was the startling manner of its heavy flight; and beyond the bar, in a shallow, weedy seepage where frogs dived for safety with webbed hind feet still kicking frantically at the surface, was a narrow, scummy lane of lingering ground water.

Not until next day, creeping through the tall arrowweeds, disturbing as little as possible the racketing Gila woodpeckers, high-crested, alert phainopeplas and gaudy vermilion flycatchers, did I apprehend the identity of the keen-eyed wader. Then it was that, bounded by parched miles of forbidding desert, I saw my first green herons! There were two in the tiny oasis. Long greenish-yellow legs dangling, they awkwardly left their negligible bog for perches high on the spreading boughs of the cottonwoods. From there, like stub-tailed fledglings, they watched with gangly, questioning necks and strange, orange-yellow orbs the consequences of this intrusion.

Possibly because some wild inhabitant of a region is rare, or rarely seen, or because it contrasts dramatically with unusual surroundings, we attach an undue measure of glamour to its occurrence there. Yet the darkly-crested herons,

(Continued on page 444)

Western black-scaled lizards of the Chiricahuas of southeastern Arizona are unawed by the camera and its glassy stare as they soak up a flood of sunshine.

Hurricane Hunters

By EDNA H. EVANS

Photographs by William J. Evans

THE weather man is not an excitable fellow. His job calls for steadiness and dependability, but even the most placid weather man cannot help but feel the thrill, the excitement and the suspense that accompany the approach of a hurricane.

The phone begins to ring as soon as the first advisory is issued. This is true in every weather station within the affected area. People want the latest reports—minute-by-minute accounts of the storm's progress.

"Will the storm come here?" worried people ask.

"How soon do you expect it?"

"Is it a bad one?"

"I hear a queer noise. Is that the storm coming?"

"How hard is the wind blowing?"

"Should we lay in a supply of groceries?"

"Is there any way we can tie the roof on our house to keep it from blowing off?"

"Do we have time to take the dog out before the storm arrives?"

Patiently the weather man and his assistants answer these questions, giving reassurance and counsel. People in exposed areas are advised to seek shelter. The proper authorities are notified. In some cases the local fire department must be instructed to hoist storm signals. Coast Guard officials, airports, life saving stations and Red Cross workers must be alerted. Bulletins must be prepared for the newspapers and the radio. Reports from other stations must be checked. Barometer readings must be taken at frequent intervals and the purple line drawn by the barograph must be watched. Every hair's breadth it drops indicates the storm is drawing nearer.

Hours pass and clouds begin scudding across the sky—torn-up wisps of cirrus flying ahead of the storm. A veil or haze appears, and through it the sun shines ominously red. Then comes the scud, and the heavy clouds of the storm. Up on the roof the anemometer begins whirling, slowly at first, then faster and faster. The hollow metal cups on its arms catch the gusts and the apparatus spins, while inside the station the recorder notes the increasing wind velocity.

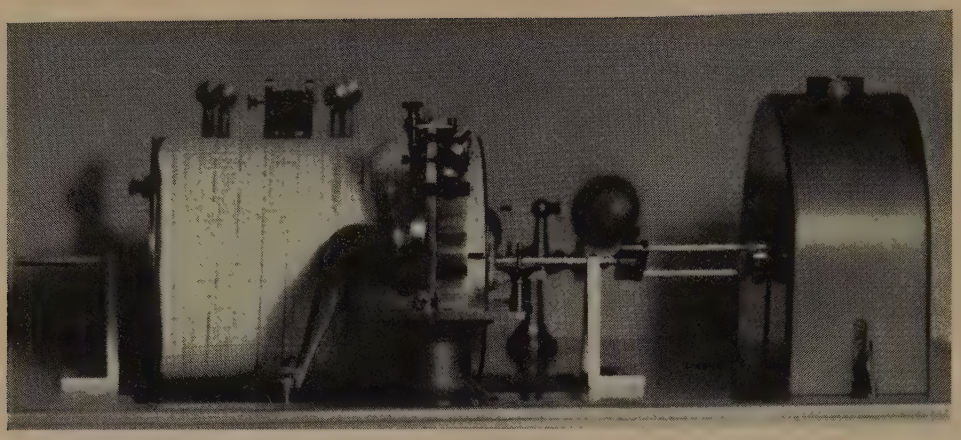
Then comes the rain, hissing horizontally over the rain gauge, blown by the wind so that only a small portion of the actual rainfall drops into the metal bucket and can be recorded. This, too, is noted on the recorder inside the station and by the weather man.

Southeast storm warnings flying at a weather bureau station. A red pennant below a black-centered square red flag warns of the tempest on the way.

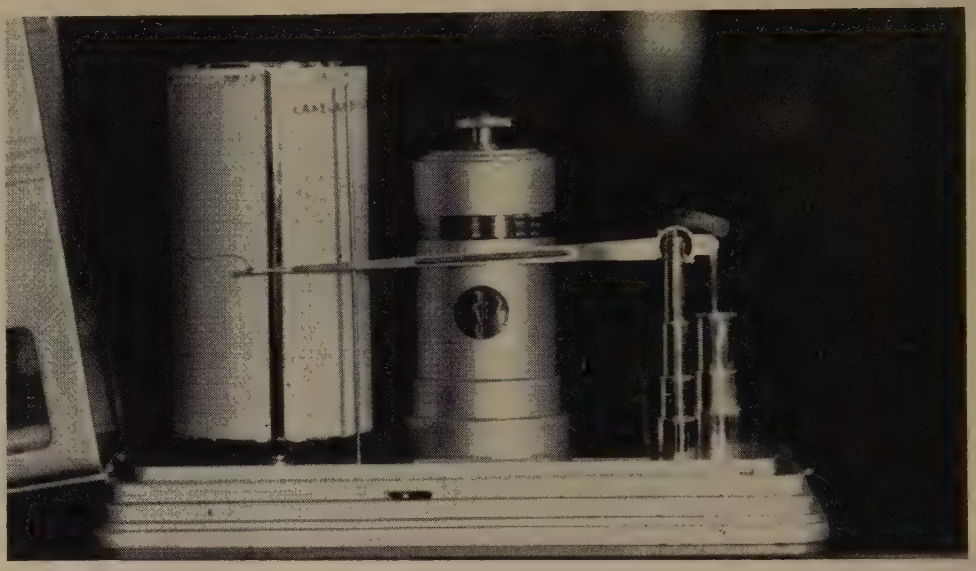
All the while the storm rages the weather men are working. There is still much to be learned about hurricanes and every change in the barometer must be noted. This is no easy task, for the violent "pumping" of the barometer is characteristic of tropical disturbances. Here the automatic pen of the barograph, recording the pressure on a revolving cylinder, is of invaluable assistance. Its record is continuous and the sheet of paper on the drum has space for four days' recordings.

When the storm's "eye" passes, more observations must be made. Temperature and humidity changes must be noted, as well as changes in pressure. That calm center in the midst of the storm's violence is a thing of great interest to weather men. Hurricane winds blow in a circle, revolving around an "eye" or center, which is windless, or in which only light breezes are stirring. The barometric pressure may rise, it may oscillate, or it may continue low. The clouds may break and blue sky appear, or the sullen grayness of the storm may remain unbroken. The weather man must record all this.

After the eye passes, and its passage may take from a half hour to as long as two hours, the winds begin



Inside the weather station the recorder, left, keeps a simultaneous record of wind direction and velocity, sunshine and rainfall. Zig-zag lines in the center of the drum show the precipitation recorded. The barograph, below, makes a record of the pressure on a revolving drum.



to blow again, as violently as before. This time they come from the opposite direction, for the station is now on the other side of the circular storm. The storm has not turned around and come back, as the uninitiated think. Rarely does a tropical disturbance double back and cover the same path again.

The weather men work under great difficulties while the storm is at its height. The continuous roar of the wind blots out every other sound, except when punctuated by the crash of falling buildings, the whine and clatter of flying debris, and the shattering of plate glass and other windows. Fire apparatus and ambulances go shrieking by, rendering assistance as long as the streets are passable. The wind-driven rain comes in sheets as thick as fog. Waves lash over the sea wall. Real lightning and the flash of swinging live wires vie with each other to add to the terror and the confusion. Electric power is usually cut off at the main switch, as a safety measure, soon after the wires go down. When night comes, the weather men work by the fitful rays of flashlights and kerosene lamps. The teletype stops when the power goes off. The phone has already gone dead.

To add to the difficulties, the wind often tears away the anemometer. Frequently reports say the wind reached such and such a velocity, then the wind gauge was blown away. Sometimes the weather station, itself, is demolished, and in not-too-rare instances the observer is killed. One Florida observer, knocked unconscious by flying debris, found himself perched in a palm tree twenty feet above the ground when he regained his senses. The building that housed his instruments had disappeared.

Of course only one station in a series of coastal observatories may feel the full force of the storm. Dozens of storms occur without ever having an "eye" pass over a hurricane station. However, during a storm every weather man must keep careful records, whether he is in the center or on the very edge of the disturbance. And the headquarters of the district acts as liaison agent between the storm and the thousands of lives and the millions of dollars worth of property that may be affected.

After the storm is over there is mopping-up work to be done, records and reports to be put into shape and conclusions drawn. The stormy season means busy times for the men who serve in the hurricane stations of the U. S. Weather Bureau.

There are certain weather men who are especially designated by the Bureau as hurricane hunters. Their job is to hunt hurricanes, by means of barometers, and by pilot balloons, radiosonde and other apparatuses for testing and recording the wind currents in the upper air. The hunt is successful when, after careful study and analysis of reports from ships at sea and from land observatories in the vicinity, the forecaster determines that a hurricane is in the process of formation, or has actually formed.

After that, by continued study of the reports that come in over the teletype, the hurricane hunter can determine the probable path of his quarry. Continued watchfulness is necessary for hurricanes are unpre-

Atop the weather station the anemometer measures the velocity of the wind as it catches and whirls the cups. Often, when a hurricane comes, the wind is recorded up to a high velocity and then the anemometer itself is blown away and the wind velocity becomes a guess.

dictable things. They may behave properly and follow the course the hurricane hunter has plotted for them. They may hesitate, remain almost motionless for hours at a time, and then go meandering off in an entirely different direction. The hurricane hunter must anticipate these moves whenever possible, and must follow after them once they have been made.

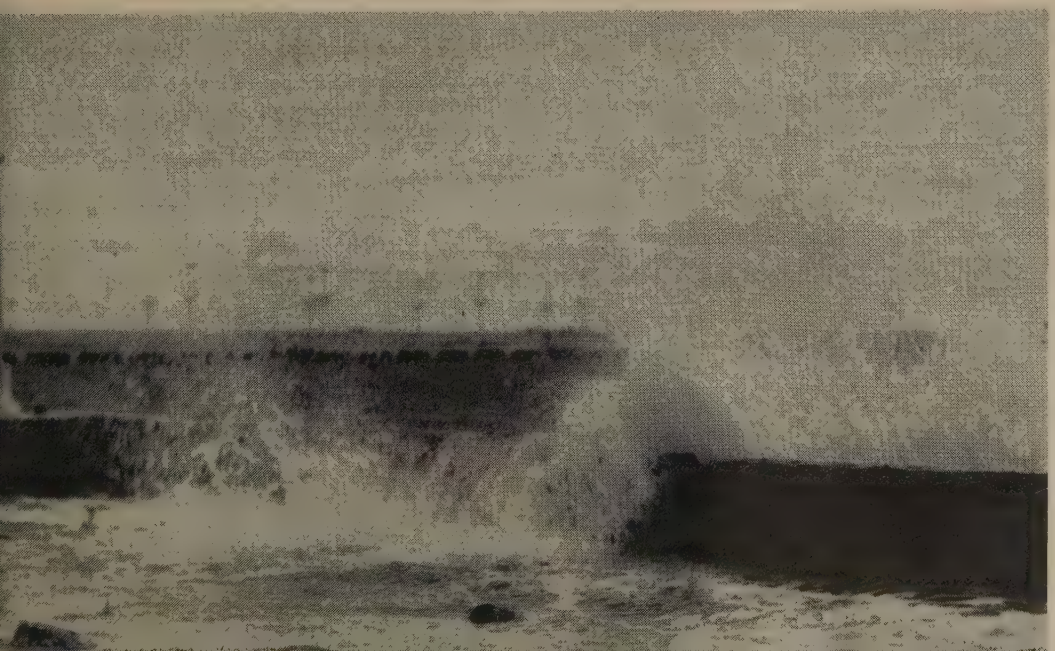
As the storm draws near to land, advisories and then actual warnings must be issued. If the storm is approaching the coast of one of our Latin American neighbors, or the British possessions in the Western Hemisphere, the proper authorities must be advised, and with all due diplomatic formality.

West Indian hurricanes—the ones that affect the Atlantic and Gulf coasts of the United States—originate in rather restricted areas. One point of origin is in the southwestern portion of the North Atlantic Ocean near to and south of the Cape Verde Islands. Another is in the western Caribbean.

Apparently hurricanes are bred in the doldrums, that stretch of equatorial calms that lies between the northern and southern belts of the trade winds. The storms seldom, if ever, originate over land, but form and move most readily over water. While they often sweep with great violence and destructive force over islands, they usually weaken and finally disappear when they run ashore.

Under the set-up of the U. S. Weather Bureau, the Atlantic and Gulf coasts are divided into several hurricane districts. Hurricane hunters are on duty during the stormy season, beginning about the middle of June and continuing to the middle of October. Hurricane stations are located at strategic points along the coast, and are linked together with special teletype wires. In this way the observers and forecasters can send their reports to a central station, can receive reports, and are also able to converse freely and to compare notes when storms are brewing.

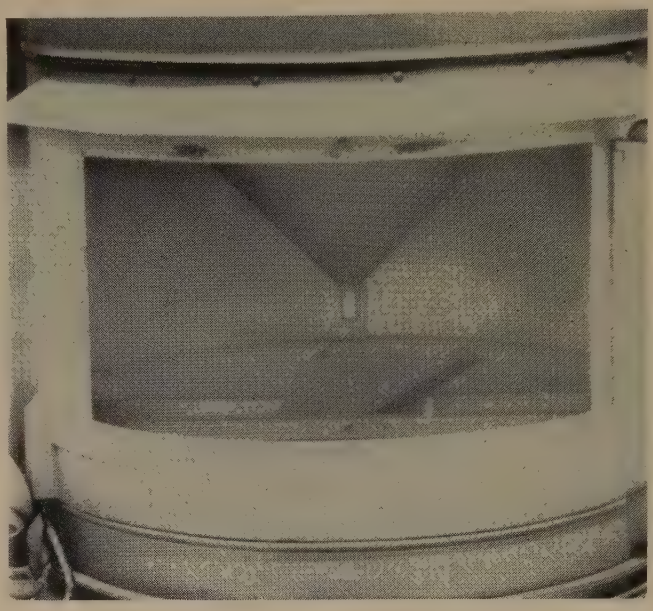
How does the hurricane hunter know a storm is forming, perhaps hundreds of miles away from his station? He gets his clues from the reports that come in at least twice a day from other weather stations. During peacetime, when ships can broadcast barometer readings and other weather information, the hurricane hunter's task is much simpler, for he may have a dozen or more readings to work with. In wartime,



Waves dash over a sea wall as the hurricane approaches. Death and damage from hurricanes are due in major extent to storm-carried water that undermines buildings and washes them before the weight of the sea, or so weakens them that they collapse.

when ships must maintain radio silence for fear of lurking enemy submarines, the weather data must come from regularly established stations on the mainland and on islands. Even so, weather forecasters are able to detect their quarry from only meager information. They have calmly stated that, the war notwithstanding, no hurricane could reach the United States coast undetected. And none has.

To the weather man, a hurricane is merely a form of cyclone, while a cyclone is any revolving, circular storm. Cyclones move across the face of the earth continuously. Their centers are the ordinary lows that appear daily on the weather map. A hurricane is a cyclone of tropical origin and of a violent nature. Cyclones, and, of course, hurricanes, rotate in a counterclockwise direction north of the equator and clockwise south of the equator.



A peek inside the rain gauge. The gathered water drops into a little bucket that holds .01 inch of rainfall, and every time it tips that much precipitation is recorded.

In addition to moving in a circle, the hurricane also has a forward motion. Winds of the hurricane may be of extreme violence, blowing from 100 to 150 miles an hour. Yet the storm's forward motion is slow, averaging only about twelve miles an hour. Thus, by watching the barometric reports and following the low pressure area, the weather man can tell the path of the hurricane. He can also estimate approximately when and where the hurricane will strike.

Since all hurricanes are born over the ocean, and since most of them move and finally disintegrate over water, first warnings must go to ships in the path of the storm. This warning service of the Weather Bureau is, of course, curtailed during wartime. A number of hurricanes charted by weather observers during the summers of 1942 and 1943 were never reported to people on the North American continent, simply because the storms were not expected to, and did not, make their effects felt on land.

The first type of messages, issued by the Weather Bureau when the storm center is still a long distance away, are called "advisories." They give the location, intensity, direction and speed of movement of the disturbance, so far as is known. However, they are not intended as actual warnings to persons living in areas where the advisories are distributed. They are simply notices that a tropical disturbance exists.

The first actual admonitions issued in connection with a tropical disturbance are usually storm warnings. These contain the same information as the advisory messages, and, in addition, direct the hoisting of warning signals at display stations of the Weather Bureau. These are located along the coast, at points where they can be seen by sailors and the operators of boats, both large and small, on land and from off shore by those on smaller vessels.

Lowest in the scale of these cautionary signals is the small craft warning—a blood red pennant flown in the daytime, but with no display of lights at night. Northeast storm warning is a red pennant above a square red flag with a black center flown in the daytime, or two red lanterns displayed one above the other at night. Southeast storm warning is a red pennant below the black-centered red square, or one red lantern at night.

A white pennant below a square red flag with a black center, or a white lantern below a red lantern, indicates southwest storm warnings, while a white pennant above the black-centered red square or a white lantern above a red lantern indicates northwest storm warnings. The direction indicated is the one from which the storm winds will begin to blow.

The actual hurricane warning, hoisted over the comparatively restricted area where the full force of the storm is expected to strike, consists of two red flags with black centers flown one above the other, or two red lanterns with a white lantern between displayed at night. Seen against the gray background of an approaching storm, even the small craft warning looks ominous. But the double display of black-centered red flags that heralds the coming of a hurricane looks as ill-omened to the modern sailor as the piratic skull-and-crossbones flag must have looked to mariners of two centuries ago.

While the hurricane winds are violent and destructive, playing strange pranks as they pass, the great loss of life in a hurricane usually comes from the storm wave and the flood waters that frequently accompany the winds. These wash away the foundations of buildings, leaving the weakened structures at the mercy of the winds. Fair-sized vessels are sometimes carried considerable distances inland and left high and dry when the storm is over.

The hurricane is by far the most destructive of all storms, because of both its size and its intensity. It means work and more work for the hurricane hunters, from discovery until it finally blows itself out.

Faithful

By ELIZABETH BUTLER LOOSLEY

Illustrated by Clarence Tillenius

YEARS ago, at Fort Klamath, Oregon, soldiers trapped a Canada goose and clipped off the first joint of one wing. After the fort was abandoned this mother goose stayed on.

Each spring her mate would arrive. Together they would waddle off until he, getting impatient, would unfold his immense wings and fly ahead, only to drift back and to walk solicitously with her to the head of Fort Creek. There, well hidden, they would build their nest in the reeds, and he would importantly stand guard, generally in the stream, for from this location he could spy a mink, their water enemy, as well as the skunk, weasel, or coyote that attack from land.

Each year, when the downy fluffs of goslings were hatched, the gander took great pride in showing off his family. He did landguard duty for the whole flock of wild geese. Wherever a flock of geese are feeding, one is not eating but on the alert, so that, at the first sign of danger, he can give warning. A few times, as the summer passed, he would take fledglings aloft, but not for long. At the goose's insistent scolding he would set his wings and the seven of them would break formation and glide down the incline of space to her. There would be loud gabbling following each training flight, and, as if to placate her, he would lead the flock to the stream where she could join in maneuvers with her family.

When fall approached she too felt the migratory urge. She kept close to her life mate. He rubbed his long neck against her breast and voiced endearments. As fall advanced she became restive and more talkative. She remembered the feel of cool air against the beat of her wing, the changing landscape lit by sun and moon, the taste of wild rice, the stirring "honk" that called to formation. She also remembered that these were not for her; that in the first chill days her family would desert her. And this they did. Standing far below she sent her clarion call into the cloud-dulled sky as she watched their forms, mere specks against the gathering daylight. Her concern during

the first few days after they had gone was pitiful. It was then she and I became such good friends.

Yet each year, for several years, she deserted me upon his arrival, lavished all her low gobblings on him, preened for him and flirted shamelessly. Then came one spring when she oiled her feathers, dusted and shone like a bride, yet the flock was late in arriving. She wandered about for quite a distance. Her coat lost its sheen. I would hear her lonesome call from afar, yet she always came in at night. But one night she did not return. Search revealed a bunch of gray feathers. I felt sure a coyote had caught her. "At least," I reasoned, "I will not have to watch her suffering when the geese take off."

Ice was forming closer to the stream's edge each morning. Spring was in the air, grass was greening. I heard a honking, and there against the sky were geese in V formation. One black speck detached itself, spiraled down and circled about. A love call rang clear, commanding. It was the gander. He alighted and walked over the ground that he and his mate had traveled on their way to their nest building. Back and forth he went for days. He went by wing; afoot. Then he left.

The next year, and the next, he came and searched the fields, the creek, even the chicken run. Hunters were more numerous, yet he seemed to lose his caution; separated himself from the band. Then, late on a fall day, as the sun was setting, he flew into a hunter's shot, thus to join his mate.

★

Te Deum

By OSCAR OSTLUND

The cricket's song, the frog's, the bird's . . .
How clearly cued
To the experience of life,
In gratitude.

★

Do Birds Fish with Bait?

By W. L. McATEE

In the sixteenth century, traces remained of a belief that the osprey or fish-hawk had the power of fascinating, or rendering helpless, its prey. Thus Peele in "The Battle of Alcazar" (1594) wrote:

> "I will provide thee of a princely ospray,
> That, as she flieth over fish in pools,
> The fish shall turn their glistening bellies up,
> And thou shalt take thy liberal choice of all."

Perhaps envy of the success of the bird led the fisherman to assign it a miraculous power. The more practically-minded among them, however, were not content with that speculation, but thought the osprey must have a material bait. This was an oily substance so potent that it allured the fishes toward the surface where they were easily caught. One of the early missionaries to the American Indians—Loskiel—recorded their belief in such an attractant which, if added to their bait, gave it an appeal the fishes could not resist.

The bait idea is extended also to the fishing of that master-flyer, the man-o-war bird. In Florida, according to Harold H. Bailey, it is known among fishermen as the "poison bird," as it is supposed to drop a substance which, when taken by the fishes, stupefies them and renders them easy prey.

Herons, as expert catchers of fishes, have not been unnoticed, and this has led to some interesting theories as to the secret of their success. There is a very widespread belief that herons and bitterns have the power of emitting light, and in some places it is believed that at night this operation attracts fishes within reach of the birds' beaks. Again a more tangible bait is attributed to one of these birds. In England the common gray heron, much like our great blue, was supposed to have something in its feet and legs that was very attractive to fishes. Hence fishermen extracted certain oily matter from heron legs and added it to their baits, especially for eels. It was believed to be very effective.

A more realistic theory than any of the foregoing is involved in a folk story told to the writer in Louisiana. There the wood ibis, or American stork, with a bare head from which scurf conceivably might be scratched, is supposed to do just that thing and with great success in tolling little fishes. In this case also the "bait" is supposed to have a stupefying effect upon the prey. I tested some of the material, and, although it was eaten by some captive minnows, no effect was observed. Scientific experimentation, however, has nothing to do with the ways of folklore, for which I am truly thankful. Surely there is no harm in enjoying folk fancies or fables even though we can not believe all that we hear.

Many ducks, such as this pair of mallards, migrate to England. The author found a leg band on one drake mallard that had been put on at the Leningrad Institute.

Instead of harming, the world conflict seems to have helped the—

Bird Life in Wartime Britain

By ERIC HARDY

As a British army officer whose peacetime hobby was the study and observation of wild birds, I have, like thousands of other folk in Britain, found that after all we had not to forget our recreation until after the war. For work and play have been combined by hundreds of amateur naturalists to make life today more endurable, and, at the same time, to find out some of the interesting changes that have gone on among the wildlife of Britain's countryside.

Only this past winter my camp in Yorkshire was "invaded" by hundreds of beautiful waxwings, among the most gaudy birds of northern Europe. Relatives of the North American cedar bird, they had crossed the North Sea off their normal route, which should have taken them into Germany and Central Europe. It is not often that waxwings do this, and it was thought at one time that severe weather in North Europe caused these occasional invasions of the British Isles. Some put the visitation down to the ravages of the war in eastern Europe; but neither view can be finally accepted. It is still a mystery of Nature.

I belong to a couple of organizations that keep a close watch on the wildlife of Britain. They are the British Empire Naturalists' Association and the British Trust for Ornithology. The first named has several dozen branches centered in various English towns; the latter operates from Oxford University and organizes nation-wide censuses and surveys.

Because the wood-pigeon hordes, which migrate across the North Sea from north Europe like winged Vikings every winter and raid farm crops, are a problem of habits, shifting their quarters without warning, the British Trust for Ornithology organized a national survey of the wood-pigeon. This has been going on each year since this war began. Thousands of specially-printed cards have been distributed so that, month by month, observers send in particulars of every bird or flock they have seen, what time of day, what the bird was doing, what it was feeding on, or the position of its nest, the adjoining field-crops and so forth.

At Oxford University these are all card-indexed, with other information, and, from the colossal files, a wealth of new knowledge about the wood-pigeon has already been gathered. It is learned that the wood-pigeons nest much later than most birds. They are at the height of their nesting season in August, when most other birds are finished with nesting. So valuable is the work for the nation's food-growing effort that Britain's Ministry of Agriculture has made an annual grant of more than one thousand pounds for the work. Filing the information received is the full-time job of expert M. K. Colquhoun, who now knows more about the habits of the wood-pigeon than

Special studies have been made of the habits of the wood-pigeon, which migrates across the North Sea from north Europe every winter and raids farm crops.

any other man among the ornithologists of Europe.

"Where does the manpower come from?" you may ask, especially when the British Trust for Ornithology is also conducting national surveys on the fulmar, or petrel, which has increased its nesting range around Britain's coasts; upon the black redstart, a famous little song-bird that nests in the old ruined buildings of continental cities and, following the war in the air, commenced nesting in several British cities and towns, including London, Plymouth and Sheffield, for the first time.

The answer is that all this field work is carried out as the spare-time recreation of many people, war-workers and men in Britain's Forces. A special Nature study scheme was started in the Army, with the support of the Army Education Corps, to organize wood-pigeon surveys by members of lonely anti-aircraft detachments and other units.

From time to time aerial photographs of special interest to ornithologists arrive from the Coastal Command of the R. A. F. at the British Trust for Ornithology headquarters. In their normal photographic duties the R. A. F. often picture some big nesting colony of sea birds, or bird flocks migrating or feeding at sea, in lonely places well off the beaten track of ships or peacetime tourists. These have proved invaluable to students of bird life, and, at the Trust's library in London, there is being built up a valuable collection of aerial photographs of the sea bird colonies all around the Scottish, Welsh and Irish coasts. Whenever duties permit, the R. A. F. fliers add special photographs to this collection. Thus we have gained a real "bird's-eye" view of the great sea bird colonies of St. Kilda and the Hebrides.

Early in the war I was walking along the Lancashire coast beside the Irish Sea when I found a dead black-headed gull, lying on the tide line. Examination showed that it wore a numbered aluminum band upon its leg. With the help of the British Museum I traced the German origin of that bird-ring. The bird had been marked as a nestling at Grossenheim in Saxony. In 1942, by the ancient city of Chester, I found a starling with another German migration ring on its leg. This had come from Rossitten in East Prussia. And, since the war, many sorts of wild duck "banded" at their nesting haunts in Soviet Russia have been recovered by naturalists in the British Isles, the numbers on their aluminum leg rings proving their identity.

These recoveries have proved a great migration route of wild fowl between North Russia and the British Isles. Pintails—which are also common in North America—have traveled between South Wales and the Petchora River and to Omsk; widgeons have

A shoveler duck is photographed on its nest by the bird photographer, Ralph Chislett. When London was bombed resident ducks left the parks, but have returned.

Many birds continue to nest in London, robot bombs or not, such as this spotted flycatcher, which goes on raising and feeding its family, war or no war.

gone from Wales to Archangel to nest, and from Norfolk to nest on the Neiva. Shoveler ducks, nesting on the Petchora and near Leningrad, winter in South Wales.

In my desk I have the ring I removed from the leg of a wild duck, a drake mallard, which I subsequently learned had been put on the bird as a duckling beside Lake Ilmen by ornithologists of the Leningrad Institute. Most interesting of all was a woodcock, banded as a nestling in Scotland, and found at Moscow in May, 1940.

Although wartime has curtailed a great amount of the pre-war bird banding that ornithologists conducted in Britain for migration study (about 4500 birds are now marked each year compared with 55,800 in 1939), results continue to be very interesting. A kittiwake, banded in wartime in the lonely Faroe Isles in the Atlantic between Scotland and Iceland, was recovered in Newfoundland.

The war has had many important effects upon wild birds in Britain. At first it was thought that the air raids would seriously disturb them, but this is not so. When heavy bombing was carried out on London most of the ducks and other water birds left the London parks, but when the raids eased the birds returned. However, the changes in the countryside due to the felling of forests for pit props, increased growing of grain to feed the nation, and the cessation of game preservation through the hunting preserve system have considerably influenced bird-life.

Many birds have actually increased their numbers and distribution. Among these are the partridges, magpies, crows, and jays. Britain had more severe winters in the first years of the war. Record low temperatures have been recorded in most parts of the country, and these cold spells drove south to the Thames at London, the Dee and Mersey near Liverpool, and other parts of the coasts, such once rare birds as eiders, goosanders, wild geese and glaucous and Iceland gulls. They were watched by people on the Thames in the heart of London. The felling of trees for timber has lost Britain—among several other species—the biggest heronry in the country.

But the most interesting news about wartime bird-life in Britain is that rare birds are no rarer for it. The black-tailed godwit continues to nest in Lincolnshire; the golden eagle increases in the Highlands of Scotland; the kites hold their own in the wilds of the Welsh mountains (their only nesting haunt in Britain); the Slavonian grebe has established nesting quarters on an Argyl sea loch in Scotland; the black-necked grebe in Cheshire; the black redstart, once a purely continental bird, has taken to nesting regularly in London, Cambridge and other southern towns.

People who never bothered much about birds before the war, some who even scoffed at the students of bird habits, have found the hobby a wartime tonic for frayed nerves or worried minds. They have recorded all manner of exciting wartime experiences. These have included a flock of 300 little auks diving and fishing in a Northumberland bay, and winter gatherings of several hundred uncommon wildfowl on the River Thames in London, at Putney Bridge and Hammersmith.

In the English Midlands an American pectoral sandpiper, a rare migrant from the Arctic that had lost its way and taken the route down the eastern side of the Atlantic instead of the western, was watched at a sewage farm at Northampton. From colliery districts in Lancashire to the famous lakes of Cumberland and Westmoreland, and to the lonely lighthouses where coast guards keep vigil, birds have been watched, studied and their activities recorded. When a new reservoir was opened in the English Midlands, several rare water fowl (grebes, wild swans and water birds) took up immediate "residence," and, by the end of the winter, seventy-one birds had been recorded at the new reservoir.

In the post-war planning of Britain, efforts are being made to create national parks, or national Nature reserves of some of the country's best bird haunts.

Birds continue to nest in London—the spotted flycatcher in the chinks of elm trees in famous Hyde Park and the tawny owl close by in Kensington Gardens. The kestrel falcons come every year to London to nest on the ledges of the Imperial Institute just as they nest on the famous spire of Salisbury Cathedral.

Craters of the Moon

Photographs by the Author

By CARROLL LANE FENTON

THE road from Blackfoot to Arco, Idaho, makes a beeline across an almost level plain. To the east rise the blue-gray Tetons; to the west a jagged horizon divides into ridge after ridge of mountains, built like steeply-tilted blocks.

At Arco the road forks, one branch plunging between two ranges on the trail of a river that disappears. The other skirts grassy slopes and climbs hills that seem to be made of cinders from some gigantic furnace. Nearby cones resemble piles of the slag that remains when ores are smelted.

These are the Craters of the Moon, also known as Cinder Buttes. The latter name is obvious; the former comes from a fancied resemblance to mountains on the moon. Also, the surrounding country is almost as barren and parched as our earth's satellite.

Not many thousands of years ago, this bare plain was a wide, rolling valley shaken by frequent earthquakes. In time these opened a great crack that ran southeastward from the White Knob, or Pioneer, Mountains. Through that break came clouds of steam and eruptions that piled lava up in cones, or blew it into cinders that shot into the air. Other lava floods rolled across the valley, cooling, hardening and breaking into irregular blocks. In some places the flows stiffened into dark glass, from which Indians one day would chip knives, arrowheads and spear points.

These first eruptions came to an end and the valley lay in quiet for tens of centuries. Then quakes began to rumble again, shaking beds of lava until the crack re-opened. Again lava poured out and cinders erupted, piling up in flows and domes, some of which rise 250 to 800 feet above the surrounding country.

For centuries these outbursts continued, breaking old volcanoes to bits as they built new ones. Then came another period of quiet, much shorter than the first one. It was followed by a series of flows that came from cone-shaped craters as well as cracks. One lava stream even breached the side of a cone, whose fragments floated away upon the rolling lava.

The region in which these things took place is part of the great Snake River-Columbia Lava Plateau, which stretches westward to the Cascade Mountains and northward almost to Canada. It covers a quarter-million square miles, and much of it is a wilderness of hardened lava, volcanoes and cinder beds. Yet no part is more spectacular than the eighty square miles now reserved as a National Monument.

Visitors cross one of the youngest, most impressive flows as they enter the Craters of the Moon. Then they park at the foot of a trail that climbs a cinder cone. The trail looks easy but those who follow it begin to puff, for the cinders roll back a large part of every step.

One stoops to pick up some cinders; as many as cupped hands will hold. They weigh surprisingly little, for each cinder is full of bubbly holes. Similar holes appear in lava that partly fills the

On the opposite page are scenes from Craters of the Moon National Monument in Idaho. Above are spatter cones along the Crystal Fissure, and, below, is the edge of a ropy lava flow, showing how the hardening rock twisted and rolled. On this page is the ropy pahoehoe flow about 600 years old. In the distance are remnants of an old, broken crater.

crater's cone. They look as if they were made by gas that bubbled up through the rock while it still was molten.

Appearance agrees with fact. Molten lava contains great quantities of gas: steam, hydrogen sulphide, hydrochloric acid and other things that are smelly or poisonous. One volcano has sent out enough steam to make 450,000,000 gallons of water in only two weeks. In Alaska, a series of eruptions produced 1,000,000 tons of hydrochloric acid in a year, besides vast amounts of hydrogen sulphide, which smells like over-ripe eggs.

Lava at Craters of the Moon contained the same array of gases. As the molten rock flowed over the surface, the gaseous mixture formed bubbles that remained when the lava hardened. Many are as small as pinheads, but others are large enough to hold a plum.

But gas could not always get out in rolling, streaming lava flows. At such times it gathered underground. It also developed tremendous pressure; so much that the lavas, already grown hard, could not keep it down.

A large volcanic "bomb" shot out when the gases within the earth built up tremendous pressure and sent forth masses of molten rock, large and small.

The result, of course, was an explosion. Compressed gas burst from holes or cracks, taking molten rock with it. Expansion filled the lava with holes and blew it into tiny bits or larger, irregular cinders. These hardened as they shot into the air and then popped into fragments before falling back to the ground.

In other places the gas tossed out large lumps of thick, doughy lava. They went a few feet into the air and then dropped one upon another, building steep-sided spatter cones.

There are spatter cones along trails, but the finest ones lie along Crystal Fissure, just a short way from the road. A smooth path leads to them, so that small children and mothers in high-heeled pumps may look into their craters.

Just north of these cones are cinder slopes covered with volcanic bombs. They, too, are lava that erupted in chunks, whirling and hardening as they shot through the air. Some look like blue-black eggs; others suggest round loaves of bread whose crust is criss-crossed with cracks. Several have long tails, formed when soft lava streamed out behind the main mass. All have bubbles formed by expanding gas.

The greatest surprise comes on a slope where bombs are very small. Again there are eggs, loaves and tailed balls, but there also are spindle-shaped affairs and others that look like twists of taffy. Few are more than three inches long, while many of the most perfect forms are less than an inch in length.

Rocks, which look still more like taffy, make up many flows. Their lava was so thin that it ran out in sirupy streams that rolled down hills, poured over small cliffs, and inundated groves of pine trees. It also cooled so quickly that its wrinkles, falls and ropy twists were hardened into stone. So, also, were the molds of stumps and logs that had charred as the lava flowed around them.

To Hawaiians such sirupy, twisted lava is pahoehoe (pah-hoay-hoay) and geologists have accepted that name. Many also use aa (ah-ah), the Hawaiian term for rough, blocky, broken lava like that which rolled out during early eruptions from the great crack, or rift, at Craters of the Moon.

In some places thick lava flows hardened, but left specially "runny" portions to gather in subterranean streams. These flowed through the hard stuff and drained away, leaving winding tunnels. Stalactites of hardened lava hang from their roofs, while their floors are marked by currents and eddies preserved as the moving rock froze.

From a distance, cinder cones and slopes have a rich velvety appearance. Aa looks old the day it hardens, but pahoehoe has a satiny surface that seems to hold the secret of everlasting youth. No one knows just when Idaho's eruptions ceased, but trees 500 years old are growing on some of the youngest flows. Other trees, quite as old, have been dead for at least a century.

This seems to mean that 600 years or more have passed since the last of these lavas erupted and hardened into stone. Yet for mile upon mile they present glistening bluish surfaces that led one early geologist to estimate their age at "no more than 100 or possibly 150 years." Near sunset, when lights and shadows shift by the moment, it is not hard to see them as soft rock that still winds its sirupy way over the plain.

JOHNSON GRASS

SUDAN GRASS

KAFIR CORN

This is the thirty-first in Nature Magazine's series of educational inserts.

Cereals and Kindred Grasses

By E. LAURENCE PALMER

Illustrated by Elizabeth Burckmyer

OATS

WILD RICE

WHEAT

OF THE many reasons why no one should attempt to write a general article on the cereal grasses and their kin at this time, two stand out as important. One is that our knowledge today of their significance to man is so different from what it was a short time ago that it is difficult to keep up with the times in all respects. Another is that, even if what we wrote here were up to the minute, it might be out of date by the time it got into print.

One of the country's leading nutrition experts expressed the opinion that our knowledge of the nutritive values of cereals was changing so rapidly that no one could hope to write anything in a given month, for publication a month later, with any certainty that it would be up to date.

Not many years ago, the chemists and physicists thought that they had reasonably stabilized their concepts as to the nature of matter. Then along came some theories that have changed our whole thinking in that field. The same is true of the cereals and related grasses, whether from the standpoint of those concerned with their nutritive value; of breeders seeking new and more valuable strains; of pathologists developing more disease-resistant strains; of farmers seeking easier ways of harvesting larger crops with less man-power, or of the geopolitician who is attempting to remap a world of peace in which the needs of people in different regions may be satisfactorily met without recourse to war.

While these reasons may discourage some, they also indicate a need for a popular presentation of some of the changes that are now taking place, or have developed recently.

When, in the Revolutionary War, the British forces moved into Philadelphia, John Bartram worried greatly for fear that they might destroy the botanical gardens that he had established near the city. In those days of gentlemanly wars, the British army had been advised by the government in England that one of the things they must not destroy were the collections of Bartram.

When the "super men" of central Europe moved east into Russia, there were no indications that they would respect the researches of the Russians, or preserve those things that contributed to the advancement of civilization generally. They demonstrated this amply in their treatment of the priceless collections in Naples. It is gratifying to learn, however, that when the Germans moved into Minsk they failed to find the results of the researches of a Russian by the name of Zhebrak. Zhebrak and his prized material had already moved to the east. This Russian scientist had managed to cross the the standard hard macaroni wheat, known as *Triticum durum,* with

RICE

BARLEY

SWEET SORGHUM

RYE

a wheat from the Circassian highlands, known as *Triticum timopheevi.* The result was a wheat that he called a hybrid Soviet wheat, *Triticum sovieticum.* This may be interesting to the botanist from an academic standpoint, but it is more interesting to the farmer to note that the grains of this new hybrid weigh nearly three times what ordinary wheat grains weigh.

We are not told in the reports available whether this means that the yield per acre of edible wheat is tripled. We are told that the new wheat is highly resistant to all known fungus diseases. This alone may lead to an increase in yield. We are glad to know, too, that Zhebrak has been working with other crosses that hold promise of considerable importance, and that our American experimenters, using the same *T. timopheevi* and crossing it with our own wheats, are getting valuable results.

The point is that we know how to produce new kinds of plants that may help us live happily ever after. We know so much more than did our workers two decades ago that the possibilities of the immediate future are obviously immense. We have come this far by combining the finding of the specialists. Geneticists, physiologists, nutritionists, cytologists, chemists, physicists, practical millers, and others whose individual interests are highly divergent, have focussed their efforts profitably in the hope of getting more satisfactory food, and getting it more abundantly and more easily—and these are laudable goals.

In the course of these developments, certain general changes must be noted. One might assume that it was always desirable to produce a grain of wheat three times as big as the normal grain. Not many years ago, the slogan of successful agriculture was to make three blades of grass grow where one had grown before. All of this was directed towards increase in bulk. In the last decade, this thinking has been changed. We are now more concerned with the production of foods of a high nutritive value than we are with the production of great volume or weight. If a small grain has the same nutritive value as a grain three times its bulk, the smaller grain may be more desirable in world trade, since it occupies only one-third the shipping space and can therefore be moved more economically. The days of buying anything on the basis of bulk are going, just as are the days of buying things primarily on the basis of their superficial appearance.

We all know the story of beriberi, the painful and fatal disease so definitely associated with those whose diet was largely polished rice. We know how much more satisfactory the whole rice is as a food, even though it does not appeal so much to the eye. The same holds for whole wheat and white bread, and for a number of other things. We are going to judge our foods of the future on the basis of their performance rather than on the basis of their appearance. We should hasten the time when this is more generally so.

It is possible that our scientists may be able to improve the nutritive value of the more attractive foods. We are already doing this in our "enriched" breads, our "enriched" oleomargarines and in other "enriched" foods. If business interests can be kept from dictating too closely the laws passed by our leaders, the time may come when we can have an abundance of cheap, wholesome food that is attractive to the sight, welcome to the palate, and available to everyone. Special privilege, lack of support to research, selfishness and ignorance may postpone the arrival of this millenium, but cannot permanently keep it away.

When the white man came to America, he brought with him many of the plants now grown here. Wheat, barley, rye, rice, oats and the like had long been cultivated in the Old World. To this list, corn was added as a native of America, but none of these plants could compete in yield with those now available to any farmer. The development of hybrid corn boosted the yield of that plant in the Corn Belt in the last two decades possibly more than it had been increased in the previous century. It is absurd to assume that we have reached the pinnacle of production here, or that production should be limited by law until the time comes when any man, here or abroad, who needs corn or other cereals in his diet can get the amount he needs with whatever contribution he is able to make to society in return for it. If the middle-man gobbles up the profits and denies a reasonable profit to the farmer or other producer or processor, adjustments will most certainly be made by an informed public.

Some of the existing public agencies are doing much to develop an informed public. The American Red Cross, for example, issues a booklet—"Food and Nutrition"—that is a masterpiece of what such a popular manual should be. It need not be paraphrased here, but it presents in a superior way the story of the vitamins, calories and other units recognized by

ne nutritionist. It does it in a language and form that can be nderstood by the average intelligent layman. Just as the re-earch specialists combined their efforts to produce a superior heat plant, so in this little booklet the specialists in teaching f nutrition combined their efforts to reach the public. The esult is gratifying. Similarly, excellent literature has been pre-ared for use by children. For example, the New York State ollege of Agriculture publishes an excellent bulletin for -H Club members entitled "What Foods to Eat and Why." ife insurance companies have contributed useful helps, de-gned, of course, to extend the premium-paying period of neir customers. One cannot, however, give blanket approval to ll of the reputed merits of this and that commercial food roduct advertised in the press and on the radio.

There is no doubt but that the war has stimulated our nastery of many of the problems of an adequate nutrition. We ave had to produce compact, adequate rations that can be nade available to men who must carry their food supply with nem if they are to win battles. We can not move the modern laborate cafeteria into the foxholes. We have had to show nen who were at the front how to recognize and harvest foods rom local sources at widely separated places in the world. In nost of these cases our men have been able to find some ereal, or some closely-related plant, growing where it can be sed to supplement the concentrated foods available in the ation kit. A boy may not recognize the woody plants nearby s being like those at home, but he will recognize wheat and orn and know that they can give him food.

It is true that no one cereal will grow in all parts of the orld, but there are few places where man lives where some ne cannot be grown, and the area over which they can be rown is being constantly expanded. The Corn Belt is expand-ng as we get new kinds that can grow in a shorter season, can ithstand more heat, or can survive more drought. The same true of wheat, of oats, of sorghum and of similar plants.

The botanist, no doubt, may resent inclusion of sorghum, ugar cane and Johnson grass in this list, since we do not ormally use the fruits of these plants as food. Nevertheless, ne plants are grasses, and do yield food to man and beast to most appreciable degree.

There are some who contend that it is not desirable to in-rease the yield of plants such as those here considered. They oint to the depressions that have accompanied cheap wheat nd corn as evidence that production should be limited rather han expanded. Such persons lack the vision needed by those places of leadership today.

It is certain that we have hardly begun to explore the pos-ibilities of the uses of these plants other than as food. Com-ercial production of alcohol from cereals, for fuel and in-ustrial purposes, is now negligible. The use of straw in the aking of cellulose products is insignificant. The contribu-ons that a rapidly expanding plastics industry may expect rom these grasses has barely been explored. Significant new ses of even the old species now raised so generally by farmers ne world over may well revolutionize the dependence of civi-zation on these plants. We may better consider the cereals as roviding the "staff of life" if we interpret "staff" to be some-ing on which we may rest our weight.

Cereal crops, when grown continuously, have contributed

DURRA, AND (BELOW, LEFT TO RIGHT) BROOM CORN MILLET, BROOM CORN AND FOXTAIL MILLET

SUGAR CANE

seriously to the depletion of the fertility of our soils. With the continued depletion of many of the rich soils of America by unwise farming and by poor soil control, there will be need for the development of new cereal plants that can maintain the existing yields although the soils available for such crops are much poorer. If we add to this the demands that may arise from newly-recognized uses, then, the need for improvement of the plants is even more urgent. When our natural resources of fuel oil in the petroleum fields have been dangerously depleted, and when it is obvious that these resources cannot be restored, one of the better alternative sources may be the larger grasses that produce a sustained yield that may help meet the fuel needs of civilization. True, we may depend increasingly on power generated by water, but there will always be a high demand for fuels that do their work by oxidation, and the cereals may eventually help greatly in meeting this demand.

Investigations of the importance of the cereal plants in the immediate future will be of many kinds. We have already suggested the improvement of yields by the activities of the geneticists. We have hinted at investigations of industry, seeking new uses and calling for new knowledge about the processing of the plant products. In addition to these, there will be an abundance of new discoveries (Continued on page 424)

COMMON NAME SCIENTIFIC NAME	SWEET CORN *Zea mays* var. *saccharata*	POP CORN *Zea mays* var. *everta*	FLINT CORN *Zea mays* var. *indurata*	DENT CORN *Zea mays* var. *indentata*
DESCRIPTION	Height: to around 8 feet, intermediate between pop corn and dent corn. Leaves: clasping at the base, curving downward. Roots: fibrous, with special prop-roots near ground.	Height: to 6 or 7 feet, but usually the shortest of the corns. Leaves: smaller than in the other kinds of corn. Roots: in general, similar to type already described.	Height: to 12 feet or more; with stems; coarse, succulent. Leaves: large, mature relatively early and are reasonably hardy and strong. Root systems: sometimes deep.	Height: commonly well over 12 feet with coarse, succulent leaves and stems that are excellent for ensilage and good, strong, sometimes deep root systems that can combat drought.
RANGE	Native of America. Common trade varieties: Golden Bantam and Crosby Evergreen. For early crops, favors well-drained sandy loams; for late crops, a richer, water-holding type.	Native of America but now grown farther north than was the original corn plant. Soil requirements in general similar to those of sweet corn.	Native of America. Flint corn is grown for grain farther north than are the different kinds of dent corn. It requires a deep, rich, sandy loam, with humus and sufficient water for best results.	Native of America. This is the important corn of the Corn Belt and the backbone of the hog and cattle industry. It does best on the deep, rich soils of the long-season mid-West.
REPRODUCTION	Annual. Staminate flowers, in tassels at top of plant. Pollen: wind-blown to "silk" or tip of pistils in "ear" lower on the plant. Mature ear: 5 to 8 inches long. Mature kernel: yellow, wrinkled, horny, more or less translucent. Immature kernel: soft, milky, sweet, edible. Seed to harvest: 90 to 100 days. Kernel is a fruit, achene.	Annual. Flowers: in general similar to those of sweet corn. Number of ears to a stalk may be a hereditary character. Mature ear: 5 to 8 inches long; relatively slender. Kernel: when ripe, hard, smooth, sharp-tipped and crowded into many rows. Hard surface essential to good "popping." Seed to harvest: 90 to 100 days.	Annual. Flowers: in general, like those of other corns. Ears: long, slender, generally yellow-brown when mature. Favored varieties are Hall's Gold Nugget and King Philip. Kernels: smooth and hard on the top, closely crowded on relatively slender cob. Seed to harvest: about 90 to 100 days, or a relatively short season.	Annual. Flowers: in general, like other corn flowers. Ears: relatively short and thick, with cob proportionately small but actually large. Kernel: indented on the top, yellow, white or red. Requires 145 days, or more, from seeds to harvest.
CULTURE AND ENEMIES	Kernels planted in hills 3 feet apart, 3 to 4 per hill, 1 or 2 inches deep, after frost danger. Planting at 2-week intervals prolongs harvest. Cultivate at least 4 times when soil is dry; first deep, then shallow after roots develop. Animal enemies include grasshoppers, earworms (in South), wireworms; plant enemy, corn smut.	Kernels are planted in hills or rows, 3 feet apart. About 5 kernels to a hill, to depth of 1 or 2 inches, after frost danger. Cultivate as with other kinds of corn. Pop corn should not be harvested until the kernels are mature but before danger of frost. Keep in well-aired, cool, dry place. Animal enemies much same as for sweet corn.	Kernels planted in hills or rows. If in hills, about 3 to 5 are planted in hills about 3½ feet apart, to a depth of 1 or 2 inches. If planted in rows, there should be about 1 plant to every foot of the row. Planting should be made after danger of frost. Cultivation: as with other kinds of corn. In the East, stalks are harvested for ensilage.	Kernels are planted in hills or rows. If in hills, 3½ feet apart. About 4 to 7 quarts will plant an acre. Planted in rows about a foot apart. Planting after frost danger. For about a quarter of a century, the average yield per acre in the United States was between 25 and 30 bushels. Depends upon man to develop disease-resistant strains.
FOOD VALUE AND ECONOMIC IMPORTANCE	Sweet corn fair energy builder for man and cattle; fair source of calcium and phosphorus for bones and nerves. Used to make alcohol, syrups, gums, starches and oils from fruits. Ton of corn yields about 90 gallons of alcohol for explosives, fuel and other uses. Paper from stalks; explosives from pith; special charcoal from cobs.	As food for man, pop corn is essentially a producer of starches that provide the usual carbohydrate parts of a diet. Pop corn is not normally fed to cattle, although the vegetative part of the plant has some silage value. Cutworms that work at night cut plants off close to the ground. Plant enemy, corn smut.	As food for man, the kernel is fair as a muscle builder (protein); excellent, as a blood builder (iron) and as a maker of energy (carbohydrate); fair for bones and nerves (calcium and phosphorus). It is fair for Vitamin A and good for Vitamin B. In West may be eaten by cattle in the fields. The ears are picked when mature, and stored.	It is not sound economics on a nationwide basis to feed corn to hogs, but it pays the farmers of the Corn Belt. As food for man dent corn is escentially like flint corn, although the volume of dent corn is much the larger.

JOHNSON GRASS *Holcus halepensis*	SUDAN-GRASS *Holcus sudanensis*	BROOM CORN *Holcus sorghum* var. *technicus*	SWEET SORGHUM *Holcus sorghum* var. *vulgaris*	KAFIR CORN *Holcus sorghum* var. *caffrorum*
Height: to 7 feet. With tough, persistent, creeping, sheathing rootstocks. Stems: ½-inch thick, smooth and leafy. Leaves: smooth, with roughened edges, conspicuous midribs, 1 foot or more long and ½ to 1 inch wide. Generally vigorous in appearance. But for perennial rootstock plant resembles sorghum.	Height: to 10 feet, exceeding the similar Tunis grass *H. virgatus*. Leaves: many, up to ½-inch wide. In general much like Johnson grass but without the perennial, spreading, tough rootstocks that make it a pest. The narrower leaves provide an easy superficial identification character.	Two varieties include: Standard, with a height up to 15 feet; and Dwarf, with a height up to 7 feet. Stems: solid and tough. Root system: in general, similar to that of corn, but more likely to be deep rooted.	Height: to 15 feet. Leaves: numerous, and broader than in most of its close relatives. Stem: coarse, pithy and well-supplied with a sweet juice; conspicuously jointed. Root system: much like that of corn, but may be more branching to form a continuous, shallow underground mat.	Some grain sorghums may grow to height of 15 feet. Kafirs are stout, with somewhat juicy stems, crowded leaves, with juice almost sour. Milo sorghum is less leafy than Kafir. Feterita, another variety, reaches a height of 14 feet and is either slender or stout, by some classed as a Durra. (See Durra.) (Hegari is variety figured.)
Native of southern Europe and Asia but now all too firmly established in southern states and elsewhere. Was introduced into United States about 1830 by Governor William Johnson of Alabama and Governor Means of South Carolina with thought that it might provide a superior pasture and hay grass.	Native, coming from South Africa and becoming established as a crop grass in the limited rainfall of our area north to central Kansas. The related Rhodes grass of central Africa does well in the dry soil of the southern part of the Gulf States.	Native of tropical Asia and Africa. Grown extensively in Europe, for the most part in Italy, Austria, Hungary and Germany. In America, Standard is commonly grown in Illinois and adjacent states; Dwarf, in Oklahoma, Kansas and Texas. Requires a fertile soil and abundant moisture. Grown in United States since 1797.	Native of Africa and southern Asia and introduced into America probably about 1875 for serious culture. Among the leading cultivated forms are Amber and Orange. It has been developed from the same species that produced broom corn, durra and Kafir corn. It is important in the South and Southwest. Grown in Egypt before 2200 B.C.	Kafir and most of the grain sorghums are native of Africa, but Kafir is probably the most commonly grown variety in the United States. Grown in India, China, Africa, and in America in the Great Plains area between the Rocky Mountains and the 98th meridian. Texas, Oklahoma, Kansas and Nebraska favor the crop.
Flowering panicle: open, spreading, to 2 feet long, with 2 or 3 branches at a joint, and more or less drooping. Spikelets: in pairs at the joints, or in 3s at the ends each containing one flower that produces a fruit. Grain: free, closely resembles sorghum grain. Spikelets: usually awnless. Blooms: June, July.	Fruiting and flowering cluster of Sudan grass about 1 foot long and half as wide; that of Tunis grass, 2 feet or more long and slender. In both, the spikelets bear awns for the most part and both are annuals. In Sudan grass, the spikelets are usually brown; in Tunis grass, green.	In Standard, the "brush" or flower panicle is 18 to 30 inches long, slender and flexible; in Dwarf, 1 to 2 feet long and much stiffer and broader. The rays or branches of the panicle or brush are naked below, stiff, and arise from almost a common point, but branch at the ends. Spikelets awned.	Flowers are borne in terminal, loose, drooping panicles, with the spikelets showing the protruding red or yellowish-red fruits from between the dark red or black enclosing scales. Amber matures early; Orange later; Gooseneck and Redtop later. Black Amber matures in 85 to 90 days; Red Amber, 90 to 100; Orange Sorgo, 110 to 115.	Mature panicles are compact, dense, crowded with spikelets and with the large grains. Varieties of Kafir include Red, White, Pink and Blackhull. Others have pink grains. The spikelets are loosely hairy, awnless, with the supporting scale about ½ as long as the grain that is broad to spherical. Annual. Pink matures in 110 days.
Thrives on great variety of soils, rich or poor, wet or dry. Does not grow during drought but grows rapidly immediately after rains. Rarely persists where ground freezes to 6 inches. Yields 2 to 4 crops of hay a year which, if cut young, is palatable and nutritious. Does not stand grazing well. Sow 1 to 1½ bushels per acre.	Sudan grass has ornamental possibilities, but its greatest value lies in its forage properties. Being an annual, it yields well to crop rotation practices and while the amount of forage produced may not equal that of Johnson grass, the quality is better and the plant may easier be kept in control.	Standard is planted in rows, 3½ feet apart, with the plants 3 inches apart; Dwarf, in rows, 3 feet apart with plants 2 inches apart. From 3 to 5 pounds of seed are used to plant an acre. In harvesting Standard, the tops of two rows are bent towards each other to form a "table" 2½ feet up.	Seed is planted in drills much like corn, when it is in rows, put rows closer. Broadcast seeding requires 75 to 100 pounds (1.5 to 2 bushels) to the acre; close rows, uncultivated, 50 to 75 pounds; wide rows cultivated, 8 to 20 pounds. It may be planted after corn and yield of forage is higher than with corn.	Kafir was brought to the Great Plains area of the United States about 1875. Commonly drilled into the soil. Provides excellent ensilage and a fair quality of forage. The area devoted to growing grain sorghums of the United States approximates that devoted to rye. From 4 to 6 pounds of seeds are needed to the acre for grain; 50 to 70 pounds for fodder.
Eradication: by prevention of seeding, by pasturing a year or two, then plowing to depth of 3 or 4 inches to expose roots to frost, disking in early summer and then planting to a crop such as cotton that is cultivated, or cowpeas that smother with dense growth. May be poisonous to cattle in dry weather. Hogs relish rootstocks.	It is possible that this plant may prove of increasing value as a crop in areas where water is not sufficiently abundant to support more common crop plants. It probably does not play an important part in wildlife management, but does give a quick hay crop when this is needed.	Raised for the brush, useful in making brooms. A crop of Dwarf should yield 400 to 500 pounds to the acre. It is sold in bales of 300 to 400 pounds of material, cured in layers to 3 inches deep after the seeds have been threshed out.	Raised for fodder, for ensilage, as a smother crop, for a fermented drink, for production of syrup. Sugar production from sorghum is possible but too expensive. As pasturage, is dangerous after frost as there may be poisonous properties developed. This disappears when plant is cured for storage as fodder. Sought as winter food by ducks in some localities.	Grains: used commonly for feeding stock, poultry, and to some extent, humans, the grains being fed whole or crushed. Breakfast foods, pancakes and bread of Kafir, locally common. Stalks: properly cured make excellent fodder. Grain: 16.8% water; 6.6% protein; 3.8% fat; 70.6% carbohydrate; 2.2% ash.

COMMON NAME SCIENTIFIC NAME	DURRA *Holcus sorghum* var. *durra*	SUGAR CANE *Saccharum officinarum*	FOXTAIL MILLET *Setaria italica*	WILD RICE *Zizania aquatica*
GENERAL DESCRIPTION	Durra includes Milo and Feterita, according to some authorities. Stems: slender to mid-stout. Pith: dry. Leaves: 8 to 10. Smaller in all respects than the Kafir, although Feterita may be almost as high. Pith: not sweet. Some durras are mature when no more than 2 feet high. Leaves: commonly break off before maturing.	Height: to 15 feet. Stems: solid and heavy as in corn, with leaves springing singly from the solid joints. Leaves: stiff, to 2 inches broad, and 1 or more feet long, smooth on both surfaces, but sharp on edges, with a prominent midrib, and long tapering point. Sheath of leaf: overlaps and is hairy at the top.	Height: to 5 feet. Stems: smooth, conspicuously jointed, somewhat branched at the top. Leaves: many, broad, flat, long, pointed, to over 1 foot long and to 1 inch wide, rough, with large sheathed bases. Root system: relatively small.	Height: to 9 feet. Leaves: to 2 inches wide, and to 40 inches long, flat, green, and curving backward from the base that sheaths the stem. Roots: relatively short, easily pulled. Two varieties recognized, variety *interior*, of the mid-West, being about 2 times height of the eastern *angustifolium*.
RANGE	Durra is native of the Nile Region in Africa from which we get the varieties most commonly grown. Yellow Milo, Jerusalem Corn and Feterita are all kinds of Durra. Closely related Shallu from India and tropical Africa, and Kaoliang from China and Manchuria, have not established themselves.	Probably native of southeastern Asia. Important sugar producing areas now are British India, Java, Cuba, Hawaii, Puerto Rico, as well as in Africa, Australia and South America. In United States, sugar is produced most abundantly in Florida and Louisiana. It cannot survive where there are killing frosts.	Worldwide in cultivation. Foxtail millet or German millet was said to be one of five species of plants that the Chinese Emperor sowed each spring in a public ceremony established 2,700 years before the beginning of the Christian Era. Other common millets are Hungarian and Japanese millets.	From the mouth of the St. Lawrence to central Manitoba, south to Kansas and Virginia and around coast to Louisiana. Common in shallow water, on muddy shores, or in water to 3 feet deep and in salinity up to 3.5% that of normal sea water. Water salty enough to be tasted is not suitable for wild rice.
REPRODUCTION	Panicle of Durra is compactly oval, erect or goose-necked (bent over). The grains are flat or flattened, large, unlike those of Kafir and are commonly white or reddish brown and are covered by the greenish, strongly-nerved scale at the base. Stems ripen with or before the grain, 72 to 82 days. Total growing period, 102 to 150 days.	Flower cluster: an open panicle, fluffy, 1 to 2 feet long, the little spikelets being conspicuous because of their white, downy tufts of hairs. In agricultural practice, reproduction is by cuttings usually from the tops of the plants. Sometimes, the underground parts are divided and used to start new plants. Perennial.	Flowering panicle compact; interrupted or lobed, heavy and usually purple, yellow or green, to 1 foot long, and to 2 inches wide. Fruits: about 1/16 inch long, smooth, yellow, brown, red or nearly black, egg-shaped, but somewhat flattened on one side. Annual. Matures 6 to 10 weeks after being planted.	Flowers: borne in loose open clusters, at the top of the plant, the uppermost bearing the pollen and the lower ones bearing the valuable fruits. Fruits enclosed in thin, papery, minutely-roughened scales. Flowering takes place in July and August in the northern part of the range. Annual.
CULTURE AND ENEMIES	Durra is smaller than Kafir, less valuable as forage, and earlier, but is better adapted to growing on dry areas particularly where the growing season is short. Plants are drilled so that they will be about 4 to 6 inches apart if grown for grain or forage, with 4 to 6 pounds of seed per acre.	Fields are plowed deeply, even to depth of 2 feet. Stable manure best fertilizer if potash and phosphorus are returned from the sugar-mill trash. Stem sections, 4 tons to an acre, are laid every 2 feet in rows 4 to 6 feet apart and covered with earth and fertilizer. Clean cultivation is necessary. Crop matures in a year.	In United States, millets are grown mostly for forage or in a crop rotation where a quick, green vegetation is needed. Varieties include black-seeded Hungarian grass; red- or orange-fruited Siberian or Turkestan millet; and the yellow-fruited, German or Golden Wonder millet.	One of the most commonly cultivated of the wild foods for game. Usually is planted by broadcasting the fruits in fall or in early spring. Ducks that have fed on wild rice and wild celery are supposed to be superior food for man. Whole grain: 9.5% water; 12.9% protein; 1% fat; 75.2% carbohydrate; 1.4% ash.
FOOD VALUE AND ECONOMIC IMPORTANCE	Durra grows slowly until settled warm weather. It then matures quickly. It is harvested by cutting and shocking and the shocked material is threshed. Durra makes good poultry food and, in some areas, the fields attract ducks for the waste grains left.	One of the most important food plants grown between 33° North and South of equator. Sugar content lost rapidly in first 24 hours, so must be removed near the growing field. Rollers remove 75% of sugar first time. Remainder is removed by further rolling and spraying with hot water. Sugar most efficient energy producing food available to man.	In India, Japan, Korea and China, millet is raised extensively for human consumption, but in America, its place is that of a quick crop to replace an early crop failure, or for forage, or for grains for poultry. It is excellent for planting at field margins and in suitable waste places, as food for certain upland game birds.	One of the more important of foods for most plant-eating wildlife. The fruits and plant parts are eaten but the fruits are most important. They attract waterfowl of all sorts, song birds, upland game birds, muskrats, deer and moose over a wide area for a considerable season.

RICE *Oryza sativa*	OAT *Avena sativa*	WHEAT *Triticum vulgare*	RYE *Secale cereale*	BARLEY *Hordeum vulgare*
Height: to 4 feet. Erect, growing from stools. Fruiting stem: angled, smooth, almost entirely enclosed by sheaths of leaves that are smooth and conspicuously nerved. Leaf blades: long and about ½-inch wide, more or less roughened. One seed will produce several of the erect stems. Over 2400 varieties recognized. Wet and dry land forms.	Height: to 5 feet. A single fruit produces from 3 to 7, erect, jointed, hollow, fruiting stems from a base of fibrous roots. Leaves: numerous, 6 to 12 inches long, and about 1½ inches wide, blue-green, rough, flat, with sheaths that are loose and extend practically from one joint to the next.	Height: to 4 feet. Flowering stems: erect, unbranched, hollow, except at the joints, to ⅛-inch in diameter. Leaves: to 15 inches long, by ½-inch wide, taper-pointed, with a long loose sheath that is finely hairy or smooth. Roots: usually mostly near the surface, but in favorable soils may penetrate to 7 feet, grow in whorls.	Height: to 6 feet. Flowering stems: erect, unbranched, smooth, except near the top, slender. Leaves: to ½-inch wide, long-pointed, soft, nearly smooth, blue-green, many, curved. Roots: fibrous, well-matted. Tallness of rye in fact and in appearance is always characteristic.	Height: to 3 feet. Flowering stems: arising in clumps up to 15 or 20, unbranched, smooth or roughened under the flowers. Leaves: short, long-tapering, pointed, to ¾ inch broad; sheaths, loose and smooth. Leaves: appear broader than in other grains and more conspicuously gray-green.
Has been under cultivation in China at least 4000 years, and as it grows wild in southern China it is probably native of the area. It was introduced into India, then into western Asia, then Europe. It was brought to America for growing in 1694 near Charleston, South Carolina. Average summer temperature above 77°F.	Probably native of central and western Asia. Although early Greeks and Romans used oats for feeding domestic animals, there is little evidence that they were used as long as most other cereals. Early American colonists brought oats. A red-rustproof oat of South was developed from African *A. sterilis*. Grown north to 69° in Alaska.	Cultivated since the first records of history and known to have been grown in China at least in 3000 B.C. It is mentioned in the first book of *The Bible*, and was grown in western Asia, Europe and in northern Africa long before it was introduced into America. It grows to within 200 miles of the Arctic Circle; in mountains at Equator.	Comparatively recent among the cultivated plants. It was not known to the early Greeks and Romans. It probably originated in western Asia and southeastern Europe. It will generally grow on poorer soils than those required by other cereals. It does best on loam soils. Pennsylvania, Wisconsin and Michigan are rye states.	One of the oldest cultivated plants. Carvings on Egyptian tombs show the plant. Mentioned in earlier books of *The Bible*. Probably cultivated as early as wheat and earlier than oats or rye; probably originated in Asia Minor from a form now wild there, *H. spontaneum*. Was brought to earliest Massachusetts and Virginia colonies.
Flowers: in compact panicles. Hull: usually yellowish-brown and the inner grain is white and hard. Rice in the hull is known as "paddy." Without the hull, it is called "cleaned rice." Carolina Gold rice, commonly grown in the Carolinas, has golden yellow hulls; Japan and Honduras rice grown in Texas and Louisiana have yellow-brown hulls.	Fruiting head: an open panicle, to a foot long, bearing from 40 to 75 spikelets, each spikelet usually consisting of 2 or more flowers, of which 2 bear fruits. In some varieties, only 1 fruit is borne in a spikelet, and in some, 3 are produced. Flowers: open for only a few hours, pollination taking place *before* the flowers open.	Flowering spikes: compact, composed of numerous spikelets, with 2 or more flowers in each spikelet. Spikes: to 4 inches long, cylindrical except in some varieties. Fruit: an oblong grain about ¼-inch long that frees itself readily from the enclosing scales and is usually fuzzy at the top. Self-fertilization is the rule. Annual.	Flowers: borne in a terminal spike to 6 inches long, well-awned, narrow, closely-flowered, with the spikelets with two seed-producing flowerlets and possibly one that does not. Flowers: more likely to cross-pollinate than do most cereals. Fruits: about 1.3 inch long, light brown, narrow, pointed, with narrow groove on face, smooth.	Head of flowers: much like wheat. Head: to 4 inches long, densely-flowered, erect, or nodding, with many stout, erect, very long beards that extend far beyond the end of the spike, some being 6 inches long. Fruit: elliptic, about ¼-inch long, short-pointed, smooth, and furrowed the length of the face, usually enclosed in the hull.
Polished rice has about 12.3% water; 79% carbohydrate; 8% protein; .3% fat; .4% ash; and 1630 calories. Unpolished rice has a higher food value. Seed is sown, 1 to 3 bushels an acre in drills, mid-April to mid-May and water is not applied until rice is 8 inches high. Water to 3 to 6 inches is then flooded in until crop is mature.	In most oats, the grain weighs 60% to 75% the total. Early oats ripen in 90 to 100 days; late, in 115 to 130 days. In late April, oats are drilled or broadcast, 2 to 3 bushels an acre this being sometimes harrowed in 2 or 3 times. Yields average around 30 bushels an acre but may reach 200 in Northwest. Hessian fly and a sawfly are the worst insect pests.	About 60% of American wheat, is winter wheat—most of which is of Turkey Red variety. 1½ to 2 bushels are drilled per acre to depth of 1 or 2 inches to mature in about 100 days of growing weather. Fields are harrowed in drilled direction. The worst enemies are rusts and smuts of wheat, chinch bugs and Hessian flies.	Planted in drills or broadcast at 5 to 6 pecks per acre, planted to a depth of 2 or 3 inches, seldom cultivated. Planted in fall or spring but matures in about 100 growing days of the spring. If planted for fall pasture, seeds are sown in August in the North or in September in the South: If for grain, September, in North, October in South.	Types include two-rowed, four-rowed and six-rowed, bearded, hooded, beardless, hulled, hull-less. There are winter and spring forms. Winter barley is less hardy than winter wheat but more so than winter oats. Winter varieties are mostly six-rowed. Almost any barley can survive winter in the South.
United States imports more rice than it raises, but it is not a major rice-consuming country. Rice bran is fed to cattle. Rice straw is made into rice boards, and straw hats, but rice paper comes from mulberry or bamboo. Polished rice lacks vitamins necessary for preventing the disease beri-beri, which in some stages may be cured by eating unpolished grain.	As food for man, are fair for protein; excellent, for minerals and for carbohydrate; and fair, for calcium and phosphorus, the bone and nerve builders. They are fair for vitamin A and good for vitamin B. About 70% of American-raised oats are used on the home farm. Rusts and smuts are serious fungus pests.	The "staff of life" as food for man is fair for protein, calcium and phosphorus and vitamin A; good, for vitamin B; and excellent, for minerals and carbohydrates. An average yield per acre is about 14 bushels but yields to 30 bushels have been reached. Very important crop in southern Canada.	Average production per acre in good states is 20 bushels, although 17 is considered excellent in others. Rye is used to make "black bread" in poorer countries and in northern Europe, as grain to feed hogs and horses in America, and in making alcohol for whisky to man's detriment. About 2/3 goes to animal food and 1/3 to flour, alcohol.	Plant 6 to 10 pecks an acre in drills, late April; expect maturity in 90 to 100 days after harrowing 2 or 3 times in direction of drill. About half crop used in making malt by germinating the seed partly. In Mississippi Valley, important in hog foods. As human food, fair for protein, phosphorus and calcium, excellent for mineral.

(Continued from page 419) associated with the culture of the plants in different areas and with the recognition of the need of farm practices different from those we may have considered standard. We have cut down the hedgerows between our fields of grain and have left the fields bare and windswept. The winter snows have melted on the other man's land and the water table under our grain field has been correspondingly lowered. We may have cut the shrubs along the fence row because of the danger of their harboring certain fungus pests that may have used the hedgerow plants as intermediate hosts. But what good does it do to protect the plant from fungi if we deprive it of the needed water and protection from freezing that may result if the hedgerow is maintained to help hold the snow? The same hedgerow may also serve to gentle the winds and thus avoid undesirable wind erosion of the valuable topsoil. True, it may be unnecessary to use hedgerows to hold snow and soil in large grain-growing portions of the country. But in areas where water supply is critical, and where disease-resistant cereals may be available, a new practice may be developed that has been frowned on in recent years.

TYPICAL CORN PLANT AND, UPPER LEFT, FLINT CORN; LOWER LEFT, SWEET CORN; UPPER RIGHT, POPCORN; LOWER RIGHT, DENT CORN.

This insert is unique in this series in that so far it has dealt primarily with broad policies associated with the organisms under consideration. The detailed significance of most of the plants is to be found in the chart section and need not be repeated here. It may be emphasized that the cereals have an interesting significance in the literature of the world and in man's history. As a matter of fact, the culture of these plants goes back about as far as does the history of any of man's activities. The Bible and all other early literature refer to the plants as being so valuable that they might even be considered the "staff of life." Heads of wheat are represented in the decorative and symbolic art of the earliest humans in the Old World, and corn enjoys a similar antiquity in the Americas. The tribal songs and dances of primitive peoples are directed with surprising frequency to the commemoration of successful crops for the year, or towards an appeal for successful crops for the new season. The need for food from these plants is recognized as being approximately as essential as is the need for success in war, whether we consider the rituals of the early human beings or whether we watch the prices of wheat and munitions in the stock exchanges of the modern world.

It is certain, however, that when the present war is over the first ships sent to carry relief to the unfortunate peoples of the despoiled world will be loaded to the gunwales with the products of the cereal grasses. Anyone who doubts that the arrival of these ships will be less welcome than the arrival of the munitions of war and destruction surely lacks normal imagination. Since it is probable that these plants will undoubtedly play a new role in the economy and thinking of the world in the next decade, it is highly desirable that a generous proportion of our population become more informed on them than is possible to present in the eight pages of this insert. This should be considered as the merest introduction to a group of plants that have been and will continue to be the most valuable of all plants known to man.

Some twenty-five centuries ago a certain king who had spent much of his life merrily boring out the eyes of his enemies, carving up his favorite soothsayers, and generally making himself unpopular, was, according to the *Bible*, brought to the lowest human level when he was forced to eat grass like the oxen. King Nebuchadnezzar, who was asked by his loving subjects to "live forever" in spite of the way he had treated many of them need hardly be pitied for the diet he was forced to follow. In fact there are those in modern times who are suggesting, without intending to be facetious, that we may sooner or later be following his example.

True, our books and our logic tell us that when we eat a nice, juicy steak (assuming that such things still continue to exist), or when we drink a glass of milk, we are merely eating grass that once grew in a field before it was eaten by some domestic bovine. An English agronomist, D. B. Johnstone-Wallace, has suggested that eventually we may be cutting corners in this food business. He has cut fresh-growing grass tips of young plants, dried them quickly, ground them into flour and baked the flour into cookies. He has reason to believe that the nutritive value of his cookies compares favorably with that of milk. Should the time ever come when our food specialists may be able to get growing grasses to yield directly a food comparable to that now attained by feeding the grass to domestic animals and then extracting it from them, our whole scheme of food economics may be changed. If the products of our farms are to take the place of exhausted resources of our mines and oil wells, it may be fortunate if we can evolve some short cuts that will yield better foods more efficiently. The possibilities here are unique. One thing is certain: changes in our appreciation of the cereals and kindred grasses are as inevitable as they are in anything we might suggest, even though many possibilities have become realities in recent years.

As We See It

A Proposal for Conservation Progress

By ARTHUR NEWTON PACK

President, The American Nature Association

Wartime has served particularly to emphasize two major aspects of conservation programs and policies. First is the now appreciated breadth of the word and recognition of the close interrelation of the component parts of any conservation program. Second is the vital need for coordination of all activities that affect our renewable natural resources, to the end that no one part shall be pushed destructively at the expense of other values.

Thus, in the field of conservation, we need to achieve a greater breadth of vision. It is not sufficient to propagandize for protection of beautiful birds, that we enjoy either as Nature enthusiasts or as hunters; for maintenance of some lovely area of wilderness where we love to travel by foot or canoe; for more fish to catch or more game to shoot. We must pay more attention to the broader aspects of soil and habitat, of wise land use. We must come to realize that a bird-lover should be as much concerned when some proposed high dam for electric power or irrigation may destroy a valuable run of salmon, as America should have been when Japan began gobbling up Manchuria, or Mussolini started to grab Ethiopia. We must learn to grasp the fundamental thesis, and the initial truth, that the joint enemy of any given conservation endeavor is human selfishness and greed. Then only can we appreciate the great strength of the forces against us, and be able to fight together with a crusading spirit for victory.

The war has indeed taught us the necessity of broader vision and a crusading spirit. The means by which our country and the United Nations have turned the tide of war towards victory have likewise proved the world's greatest lesson in coordination and cooperation. The practical feasibility of joint operations by a multitude of different agencies, even by two such individualistic departments as War and Navy, has been demonstrated and achieved. No obstacle is too great, provided the will to surmount it can be joined.

This latter lesson is especially applicable to the field of conservation. In the United States a dozen Federal agencies are concerned to a major degree with natural resources and their use. Some of these agencies are independent, such as the Federal Power Commission; others are so constituted as to be little affected by conservation thought, such as the Public Roads Administration in the Federal Works Agency and the Army Engineers in the War Department. The remaining agencies are divided between the Department of the Interior and the Department of Agriculture administratively, and are still further separated—by wartime exigencies—geographically.

These conditions militate against coordination of programs, make for duplication of effort, and cause dangerous waste of resources and values through failure to consider all the elements involved. The Coordination Act of 1934 sought to bring about a meeting of the minds, but it has been too often ignored, bypassed, or given only lip-service.

Recognition of the vital and inseparable relationship between the land, waters, forests, and wildlife requires a comprehensive view of conservation and emphasizes the necessity of coordination. Use of land or water must be based upon their best use in the public interest; it must preserve all the values to the utmost possible degree consistent with achieving this highest use. This result can never be accomplished without carefully weighing all these values. And to weigh these values there must be conference and agreement among all the agencies and interests concerned.

This is a matter of immediate importance. Post-war America will embark on a multitude of programs. The plans are drawn for many of these. There will certainly be a demand for made-work through public agencies and public projects. Most of these will have varying impact on natural resources. We cannot afford to have any of these duplicated, unnecessarily over-lapping, destructive or precipitately planned. There must first be initial planning; then coordinated consideration; then performance.

There seem to be two logical means of achieving these ends. First would be the creation of a Department of Conservation in which would be placed every agency, the major part of the work of which is with natural resources in land, water, forests, parks and wildlife. Logic is on the side of such a move, even though departmental jealousies and bureaucratic precedent, not to mention politics, are not. We should like to see created a Department of Conservation, or a Department of Natural Resources, in which would be gathered at least the Soil Conservation Service; the U. S. Forest Service; the National Park Service; the Bureau of Reclamation; the Federal Power Commission; the Fish and Wildlife Service; the Grazing

Service; the Indian Service, and the General Land Office.

Such a realignment, logical and desirable as it should be, may not be easy of achievement in wartime. Indeed, it might be unwise to try to achieve it in a time of preoccupation with war.

Yet it is important that the objectives of such a Department should be given consideration in wartime as an essential factor in post-war planning. The alternative, then—and one that does not need to await victory—lies in accomplishing within the existing bureaucratic structure the vital coordination sought. This could be achieved through a coordination law with teeth in it. This law should create a Coordinating Board on Natural Resources, representative of all the agencies that would logically be included in the aforementioned Department of Conservation and some others. This board should be charged with the consideration of every major project concerned with the exploitation of a natural resource and which in any way affects more than one value of that resource. It would have the responsibility of reconciling the interests of every agency whose administrative or jurisdictional responsibilities relate to the immediate project under consideration.

If, for example, it is proposed to dam a river for the purposes of power, irrigation and/or flood control, the importance of the aquatic values should be presented by the Fish and Wildlife Service; the place of soil conservation in flood control by the Soil Conservation Service; the effect on and of forests by the Forest Service; the reclamation need by the Bureau of Reclamation; the specific effects of the project by the Army Engineers; the justification of the power development by the Federal Power Commission. All the values should be weighed and the program adjusted to achieve the utmost possible preservation of *all* these values. No project affecting more than one resource or one agency should be carried into effect without the consideration and approval of this Board, or without full public information on the proposal, its objectives and significance.

As an essential corollary to this board, there should be created an Advisory Board representing the public. This advisory board should have ample time and opportunity to consider all such projects in detail. Conservation organizations representing the public view are of sufficient size, importance and competence to have an active part in the framing of conservation policies and programs. Indeed, it is these public organizations that pioneered in conservation; that educated the public to an appreciation of conservation; that made the government agencies what they are today. The public can no longer be told about projects after they have been carried to a point in planning where the public view cannot have its rightful influence.

Such an advisory board should be made up of representatives of national organizations of proved performance and standing in the conservation field. It should include, at least, the following organizations: American Fisheries Society; American Forestry Association; American Nature Association; American Ornithologists' Union; American Society of Mammalogists; American Wildlife Institute; Emergency Conservation Committee; Friends of the Land; Garden Clubs of America; General Federation of Women's Clubs; Isaak Walton League of America; National Audubon Society; National Parks Association; National Wildlife Federation; Wildlife Society.

This board should meet frequently, both as a board and with the Coordinating Board of Natural Resources. In the meantime means should be created to keep the constituent organizations of the advisory board informed on projects planned for consideration.

The time has passed when conservation can be a helter-skelter program complicated by bureaucratic jealousies. Nor should programs, carried out in the name and under the guise of conservation, be consummated without the public being given all the information and ample opportunity to influence such programs. American men are dying all over the world to preserve freedom. Those charged with the wisest use of our natural resources cannot let them down by ill-advised use of these resources.

With victory in war come the problems of peace, wherein former allies and former enemies must still manage to get along together. All of the broader aspects of this situation may be summed up under the head of practical tolerance and respect for the just rights of others. This has a particular meaning for us as believers in conservation. It is not possible or necessary to assume that all conservation groups will think exactly alike in all details, for nearly every group has particular obligations to assume and special problems connected therewith. We have extremists and conservatives, but the world should belong exclusively to neither. The world may be a long way from central government under a single elected authority, and so high a degree of centralization might be dangerous. Similarly, we do not believe that any single conservation group needs to dominate or obsorb the others. We feel rather that, through the advisory board or council suggested here, through more individual contacts—formal or informal—between executives of our present large number of conservation organizations, more harmony can be achieved. Several attempts at meetings of conservation association leaders have recently been made and the participants have greatly profited thereby. We believe that these attempts could well evolve into a beneficial common practice. We believe that the smaller and specialized groups, like the smaller and weaker nations of the world, should be heard, and credited with the fair degree of their accomplishment. If we are to embark upon a crusade, let it not be limited by any sect, or swallowed up by any thirst for personal power.

The values and possibilities of a small sanctuary are demonstrated by the—

Shepard Wildlife Preserve

By NELSON A. JACKSON

WHY create another sanctuary? Are the results worth the labor, the expense and the care? Is not the country dotted with them from Maine to California?

There are, of course, many large sanctuaries, or refuges, and an unknown number of small ones, both public and private. But there should be more. Some of the areas are for the protection of forest resources only. Others have been set aside so that threatened species—whether they be the giant redwoods, the trumpeter swan, the bighorn sheep, or others—may be preserved from extinction, or given a chance to increase. The results obtained from our large Federal refuges—although they are largely created to increase the numbers of game birds for shooting — have been so successful that none would question their value and necessity. The individuals and societies that have been foremost in creating and maintaining havens for specific endangered non-game species have proved the worth of these efforts.

The saving of the wood duck is an excellent example of what protection will do. About twenty-five years ago it was predicted that this beautiful bird would be gone in a decade. A closed season was declared and the birds increased, although they have now been returned to the game lists. However, this experience in protection shows what it will do for bird numbers, and a sanctuary is national protection in miniature.

There are many small preserves set aside for the preservation of native flowers. Gene Stratton Porter provided an example on her Limberlost estate—now threatened with destruction—during the first quarter of this century to save from extinction many of the wild flowers native to that section.

Conceding the value of the large preserves and sanctuaries, one may ask, what is the use of trying to create a sanctuary only a few acres in extent? This was the question that ten years ago was being discussed by the Keuka Park Conservation Club. This organization, whose efficient president is Professor Hazel Ellis, head of the department of biology at Keuka College, is composed of the Nature enthusiasts from the Keuka College faculty, the community, and the nearby villages and countryside.

It is the conviction of the American Nature Association that many small wildlife sanctuaries, maintained by individuals, groups of Nature enthusiasts, schools and other institutions are vitally important. They provide haven for birds and mammals and preserve vanishing flora. In support of this conviction we will publish in *Nature Magazine* a number of articles about existing sanctuaries in the hope that the experience gained in these, and the methods used in maintaining them, will serve as suggestion, inspiration and practical value to those establishing such areas.

The officials of the College were co-operative and willing to turn over to the guardianship of the Club a wooded corner of the college farm. The offer was accepted, and therewith started the first project of the organization. The original preserve was a plot of about ten acres in extent. It was sparsely-wooded and covered with underbrush. A small stream runs through it. There are ledges, low, wet places, and dry, sloping banks.

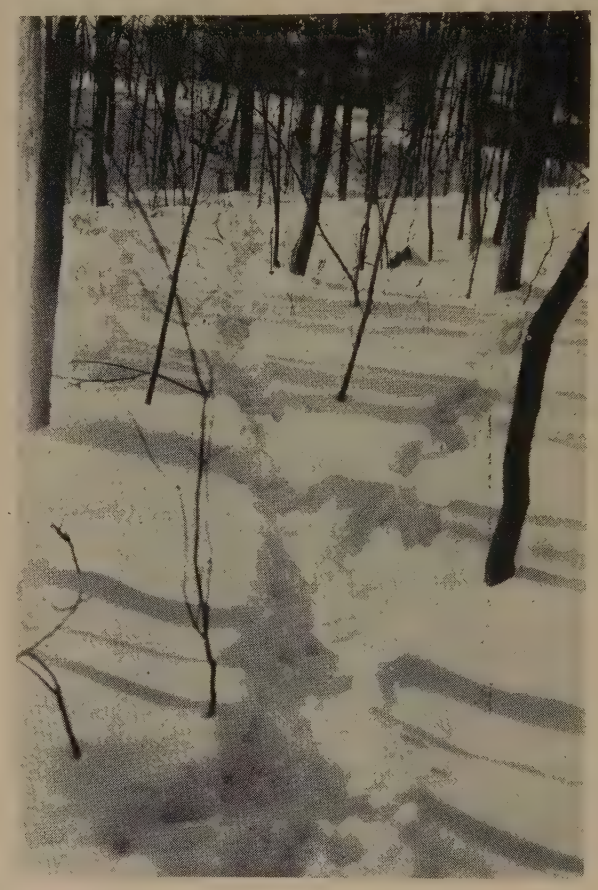
The Club wished to establish in the protected corner some of the wild flowers, shrubs and ferns native to Yates County, New York. Many of these flowers had formerly thrived in this very spot but had disappeared at the hands of thoughtless wanderers, wild flower snatchers and despoilers who grab root and all, only to throw the plants aside in a short time. It was hoped that these wild plants would reestablish themselves, thrive and multiply. Some of the varieties that had practically disappeared from the Keuka Park area are bloodroot, trilliums, spring beauty, yellow and pink moccasin flowers, as well as ebony spleenwort and the walking fern. The location has proved to be ideal for the project.

From the first it was realized that not much could be done for the birds and mammals except to protect them in the small area of the preserve from the guns of the hunters. There are no funds for fencing. How-

ever, few dogs and practically no cats wander habitually through the sanctuary.

Two years after the first grant about forty acres of adjacent woods and rough pasture were added to the area. Its eastern boundary is about thirty rods from the shores of Lake Keuka. From here it stretches for about 3/8 of a mile along both sides of a small meandering stream, called, by old settlers, "Sucker Brook." Most of the area is similar in character to the original ten acres. There are many oaks and hickories, some elms, soft and hard maples, a few white ashes, and one fine old sycamore. A few of the oaks and hickories are two feet in diameter. In the tops of many of the older and larger trees owls and woodpeckers find excellent nesting sites. For most of the way the creek runs along the foot of a gentle slope with a southern exposure.

The preserve is named in memory of William Shepard, an ardent Nature student, who was a charter member of the Club and did much to procure the grant of land from the College.



New York State rabbits are patriotic as they make their paths in a V for Victory through the woods of the Shepard Wildlife Preserve.

There has been no attempt to keep the underbrush out; rather its growth has been promoted. Its presence is an encouragement to birds and the furtive creatures of the wild. There is no desire to make a park or picnic place. It is the wish of the people in authority that only those genuinely interested in Nature should wander about the area. At first there were periodic collections of old sticks and rotten wood into neat piles, which were left to be consumed by Nature's slow decay. The custom has been abandoned. The object now is to leave the preserve just as Nature arranges it. Those who have a real desire to do so can easily make their way. Its wild state makes a real appeal to such wanderers.

There is no formal nor inviting entrance. One just ducks under the underbrush and proceeds as quietly as he can, especially if it is the warbler season. Near the eastern side, in an out-of-the-way corner, is an old stone quarry, the bottom of which is always wet and marshy. Here beautiful tall cattails abound, in the midst of which one may, if fortunate, find a bittern, a rail, a little green heron, a short-billed marsh wren, with warblers of many kinds in the branches above.

Near a rustic bridge, snuggled among beautiful elms and hickories, is the attractive home of the Seymours. Their back yard, which in reality is a wild flower garden, extends right into the preserve. Mr. and Mrs. Seymour, although not officially so designated, are in actual practice the guardians of the area. Anyone passing along either bank of the stream—intent on picking forbidden flowers or collecting specimens—is quite sure to be interviewed. The Seymours are the outstanding botanists of Yates County. Their herbarium of Yates flora is the largest and most complete of any privately-owned herbarium in western New York. It contains about 3000 specimens and is unusual in its collection of ferns. It compares well with the herbariums of local colleges. Mr. Seymour is collecting data that will furnish source material for an up-to-date and exhaustive description of the flora of Yates County.

"Sucker Brook," at all times attractive, becomes in winter a special thing of beauty, as it placidly flows between its banks of white, or, with a pleasant gurgle, scuttles beneath bridges of ice and snow. In fact, for me this is the most alluring season for a walk in the Sanctuary.

On a morning the day after a medium snowfall there are so many stories written that one is more than busy for hours trying to read them. The rabbit tracks are the most abundant. At first, they seem greatly scattered; then these tracks begin to converge until they form a well-defined runway. These paths are often six to eight inches in width and about the same in depth. I never find one of these runways without marveling at the great amount of traveling done by the shy wood folk during the hours of darkness. At one place a single line of tracks comes to a tragic end. There in the snow are the clear imprints of an owl's wings. Blood stains and bits of fur tell all too plainly the story of silent, sudden death. The delicate tracery of the tiny tracks of the deer mouse causes one to stop and wonder how such a minute creature manages to survive the rigors of a northern

winter. The pheasants have also been abroad looking for food, no doubt searching for the corn and apple parings that were left the day before. Without question the squirrels have been searching for the same articles of diet.

With the extended area at its disposal the Club redoubled its efforts in carrying out its wild flower project. Plants of some varieties were purchased and started in the preserve, while many more were carefully transplanted from unfrequented areas of the county. One notable success is the quick spread of the bloodroot. In spring there are now many patches of beautiful white scattered along the borders of the stream.

At a recent meeting of the Club plans were made for the addition of more specimens to the wild flowers already in the Sanctuary. All members were warned not to transplant flowers in any quantity from sections where they are now thriving, but to seek areas where the woods were being—or had recently been — cleared away in such a manner that the native flowers might not continue to grow.

The yellow moccasin flower is making a comeback in the Sanctuary along with other wild flowers that had formerly been abundant.

Probably the rarest plant in the preserve is the walking fern. This plant does not look like a fern with its long, smooth, tapering fronds. It is sparingly distributed throughout the East, but is unusual in Yates County. This fern prefers a limestone ledge but will grow on granite or gneiss if other conditions are right. Above "Sucker Brook" the few plants are clinging to an outcropping of shale. It obtains its name from the fact that the long, thread-like runner tips of the fronds will pierce a clump of moss and there take root and produce a new plant. It thus walks away from the parent and starts a new cycle of growth. To my knowledge, the walking fern has grown on this same ledge of rock for the past forty years. During all that time there has been little, if any, increase, largely because of the ravages of specimen collectors.

Another fern rare for this vicinity, the ebony spleenwort, has been transplanted to the preserve. It has accommodated itself rapidly to new surroundings and is spreading in a satisfactory manner.

Birds were quick to recognize the sanctuary offered by the preserve. In the spring it is truly a paradise for warblers, some of which linger for the summer. The list of the less frequently seen birds found in the Sanctuary and vicinity does not contain the names of any that are really rare; however, it does have the names of some which are not abundant. The list includes wood duck, red-headed woodpecker, short-billed marsh wren, rosebreasted grosbeak, yellow-bellied sapsucker, yellow-billed cuckoo, the great-crested flycatcher, blue-headed vireo, great blue heron, American bittern, kingfisher, screech owl, cerulean warbler, Louisiana waterthrush, winter wren, and the pine warbler in December.

A composite of the lists of most of the members of the Keuka Conservation Club shows that at least 125 different kinds of birds were identified in and near the preserve for the season of 1943.

Not many four-footed denizens of the wild consider the area a place of sanctuary. Gray squirrels and rabbits are abundant. There are a few red squirrels and chipmunks. Usually a few skunks and woodchucks live in the bank well above the stream. Now and then a fox trots through; a muskrat makes his way up from the Lake, or a group of deer will be found browsing in the preserve, or, more likely, in a neighboring garden.

The most important project undertaken by the Conservation Club in connection with the preserve has been that of reforestation. In 1934 and 1935 about 2500 small white pine, Norway spruce, hemlock, and black cherry trees were planted throughout the area. In the part of the Sanctuary where there is an open grove of oaks and hickories the white pines are making a satisfactory growth, some of the trees being now three feet tall and well developed. On some of the steeper slopes a few Scotch pines are doing well. The spruce, hemlock, and black cherry have not thrived. However, considering poor soil conditions, the project has been a success.

Truly this haven has provided an opportunity to hear "the various language" of Nature, and is unquestionable proof of the benefits of the small sanctuary, both to wildlife and its protectors.

Hitch-Hiker from Florida

By ALBERT R. FLOYD

Photograph by Alex Phillips

THREE years ago a small green tree frog popped out on the kitchen table from where he had been hiding in the rough outer leaves of a cabbage head that had been shipped to Chicago from Florida. He is still living and has proved to be an interesting pet.

As I am a shut-in, and could not provide a culture of fruit flies, feeding him was at first quite a problem. He insisted upon seeing his food move. Mealworms, large or small, did not agree with him too well. Although apple and soft green worms did, they were too scarce to be depended upon. But I finally found a diet and worked out a feeding schedule for him. In summer I release three live house flies per day in his screen cage for him to catch, skipping every sixth day. In winter I supply him with a live roach (Chicago Standard Size) every fourth day. If fed oftener he becomes ill and paralyzed in his hind legs. I can now induce him to eat fresh ground meat by tickling his nose with it, but it does not seem to agree with him. I have never yet seen him take a drink, but he likes to sit in a glass coaster with about a quarter inch of water in it.

The first summer that I had him, his croaking was a constant source of amusement. His croak was in reality more of a bark, like that of a small dog. It was loud enough to wake light sleepers in other apartments, even with all doors and transoms closed. The sound was nothing at all like tree frogs on the radio. Any loud noise would set him off—slamming doors, loud-voiced radio announcers, and passing fire trucks. For good measure he would have a croaking spell about every six hours night and day without any apparent stimulus. Often when barking he would cut loose with a volley of twenty or more rounds. At such times he inflated his throat until it formed a hemisphere about three-fourths the size the rest of him. For reasons unknown to me he has not croaked since his first fall in captivity.

I introduce his food into his cage in a small flat one-ounce pill bottle, the neck of which is too small to admit even the first joint of my little finger. Yet he has no difficulty entering it, turning around and coming out again. His toe cups doubtless give him excellent traction.

"Stumpy," the green tree frog, arrived in Chicago from Florida in April, 1941, traveling in the outer leaves of a cabbage. This picture was taken two and one-half years later.

Despite this ability to get in and out of tight places, on the several occasions he has escaped his cage he has always stayed out in the open. Until he became tame he led me some merry chases about the apartment. He is a good jumper, about as good as any frog his size, and his cups enable him to stick wherever he lands. He can travel up a window pane at a pretty good pace.

I have read that he is the most beautiful of all the frogs. I can well believe it. Normally his color is a bright Irish green, free of any mottling, and there is a metallic stripe of gold around his mouth and down his sides and hind legs. He has some ability to change color, although only through shades of green. While he is sleeping, his skin shines with a porcelain-like glaze. Visitors sometimes think he is made of china and that I am spoofing them by having him in a cage. He spends most of his days in deep slumber, coming to life about nine in the evening. I have no idea as to his age since he was already full grown when he arrived in Chicago three years ago.

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Kindness Pays

By LELA M. WILHITE

I carefully raked
The lawn today,
Then came inside
So leaves could play.

Fearless, an enemy of vermin, the mongoose is admired by our servicemen in Hawaii as—

Nature's Original Commando

By E. D. NEFF

A birdseye view of a mongoose. It had to be photographed in a well because that was the only place in which it would stay still long enough for the cameraman.

AMERICAN servicemen billeted on the sunlit Hawaiians are encountering for the first time, and quickly coming to admire, an animal banned by law back home—the swift and deadly little mongoose.

Zoologists believe him to be one of the fastest fighters in Nature, and his willingness to attack the sinister Indian cobra sets the ring for one of the classic battles of the wilderness. Already, one Marine has dubbed the mongoose Nature's original commando, and before the war in the Pacific has ended the little mongoose may have earned a place on the battle pennants of more than one outfit of U. S. fighting men.

The friendship of our servicemen for the mongoose is natural. Like Americans, the mongoose fights only vermin, if there are enough around to keep him busy. Even when the fight is uneven, as against the cobra, he always attacks, and usually wins. He has no fear, except of humans. When cornered, however, he will spit and leap at intruders, his fur bristling ominously.

Typically American, too, is the mongoose's character. He seems like a combination of animal "nationalities." His Swiss-watch brain and superb coordination are combined with the fighting traits of the mink, civet, weasel, skunk, and cat. Excepting the skunk, he performs as though he had stolen the most deadly weapons from each of these. In action, he looks like a combination of a 20-millimeter machine gun, Joe Louis and a buzzsaw going at top speed.

The mongoose has the cat's needle-like teeth, the civet's speed, the furtive, crouch-fighting technique of the weasel. Yet the mongoose never grandstands; fights his natural enemies only when attacked or in need of food. Most of his battles take place in the privacy of the Hawaiian cane fields, the Indian jungles, or wherever his widespread species are found. He minds his own business when left alone, and is afraid of nothing when molested.

If Americans were in all respects as gifted in the science of battle as the mongoose, they would have been prepared to strike their reptilian enemies long before they were so obscenely taken at Pearl Harbor. For the mongoose's sensitivity to danger amounts almost to magic. The faintest sound and he rears up on tiny hind feet, scouting the territory like a submarine periscope. Even when tamed, he plays only for brief intervals, interrupting his fun for frequent retreats to a clump of bushes for swift reconnaisance.

Again an admirable example for 130 million peace-loving U. S. citizens, the pert little mongoose never allows his weapons to become rusty. Like all great natural performers he begins his trade with infancy. A research director for the Hawaiian Sugar Planters Association in Honolulu was given a baby mongoose as a pet. He kept the infant in the toe of an old slipper, gave it a flannel rag to hide in and fed it milk from a dropper. He named it Ricky after Kipling's

mongoose. At the gentle age of six weeks, Ricky was snapping at human fingers. His first major battle, while still no bigger than a mouse, was with a huge cockroach. Ricky, squeaking the mongoose battle cry, squared away, then rushed in to attack.

In considerably less than a second the cockroach's head was missing. A few days later he attacked a giant centipede. This time he had a new angle. Following the decapitation, he rushed in again and bit off the centipede's abdomen. When he found a screen door open he would slip in the house and begin an attic-to-cellar search, which included the spaces between sofa cushions. Anything that crawled drew fight from Ricky. In between, he slashed away at old rags, happily sharpening his teeth.

To most Americans, the mongoose is little known except in the movies. Our animal "immigration" laws bar him on the not too well established grounds that he is a chicken-killer and a "menace." The mongoose —of which there are some thirty species, the most common and best-known being *Herpestes nyula* and *H. griseus*—was imported to Hawaii from Jamaica in the last century to help control rats, which were destroying twenty-five to forty percent of the sugar cane. Rats love sugar cane, and mongooses hate rats. It was a natural, since the mongoose apparently will not eat sugar cane even when hungry. Some time after the importation, the old cry went up from Hawaiian poultry raisers that their stocks were being molested. Laws were passed against the mongoose, and a bounty of fifteen cents placed on his head. Nothing came of this, however, as Island head-hunters took to saving their trophies, then bringing in the lot to the tax office. The stench was enough to discourage enforcement of the law, and today the mongoose runs virtually unmolested except by dogs.

Meanwhile the Hawaiian Sugar Planters Association, which has a natural friendship for the mongoose, paid one of their research scientists to discover the truth about the mongoose and poultry.

Cyril E. Pemberton, the scientist selected, examined the stomach contents of 356 mongooses at the Association's experimental laboratories in Honolulu. He found mainly only scraps of mice and rats, fruit, insects and toads. No feathers or parts of feathers were discovered. Mr. Pemberton does not argue that a mongoose will not attack chickens or young birds. But he does believe that the mongoose gets the blame more often than not for the dirty work of rats. Poultry raisers find the bird remains, and, having seen a mongoose in the neighborhood, assume he is guilty.

The name "mongoose" is an English phonetic attempt at the correct Indian term, "manegos" or "mungoos." This doubtless has caused the confusion about the plural, which, of course, is formed by simply adding the letter "s" to "mongoose." Hawaiians say "plenty mongoose."

Soldiers, sailors and Marines, marching or riding by jeep over sugar plantation roads on Oahu, never see a mongoose lying dead on the asphalt; he is far too fast to be struck by an auto. Frequently, however, they will see his pert little face peering out of the cane, and mistake him for a rat or squirrel. The mongoose is larger than either, and, unlike the rat, has a bushy tail. He may reach a length of one-and-a-half feet. He is slender, elongate, built close to the ground. His brownish-gray fur is white ringed and stands erect in a ferocious bristle when he is alarmed or angry. The mongoose lives in burrows, and his tiny ears are covered by a flap to keep out dirt when he is digging for a rat litter or insects. His hours are neatly adjusted to the rat's time clock. The mongoose hunts rats while they sleep by day.

Unfortunately, the mongoose is not as fast a breeder as the rat. This discrepancy has made it necessary for the sugar planters to use poison against the rat population, the poison being carefully selected so that it is made harmless by the rat's digestive system. A mongoose will eat a dead rat. There are no snakes native to Hawaii, so the rat has become the mongoose's favorite victim.

As a fighter, the rat is no slouch, yet against a mongoose he cowers and tries to run. The mongoose sweeps in like a tracer bullet, grabs his victim by the soft neck scruff. His jaw muscles tighten until sharp teeth find the nerve cord. No amount of thrashing will save the rat in the seconds of life left to him. The mongoose hangs on.

The mongoose, to be sure, is no beauty. For Flag Day exercises he lacks the lordly eagle's stance. But as a symbol for America at war, vermin everywhere would recognize him as a fighter with the sting of death in his teeth. Some strategists like to compare his technique with the present direction of the war in the Pacific. Nearer and nearer the swift U. S. fleet sweeps toward Tokio. Already the rat begins to cower.

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Potentialities

By CAROLINE WADSWORTH TURNER

Potentialities in clouds
Are without number,
They may be only whiff and whim—
Last night they broke in thunder.

Backyard Orchard

By ANDREW S. WING

FRUIT trees in the home garden are coming back into style. There is, of course, nothing more beautiful than an old apple tree in bloom, and plum, peach, pear and other useful fruits have their days of decorative charm. But the fruit you harvest is most important, as days of scarcity and high prices have shown so many of us. A home orchard, even of a few trees and bushes, can make a real contribution to the family table. Wartime has emphasized that one's own tree-ripened fruits are much more flavorful than the train-tired kinds from distant commercial orchards.

For centuries Old World gardeners have practiced "three-story gardening"—vegetables on the ground, vines and bushes as a second story, with trees the third. We may often have more space, but a grape vine shading a porch or terrace, or serving as an arbor, is fruitful and decorative. Espalier fruit trees that cling flat to a wall, or are trained along a walk or against the sunny side of the house, are both interesting and attractive. They are surprising in the quality of their fruit, bear well in comparison to standard or dwarf trees and are easy to care for.

Many people, thinking of trying out a modest backyard orchard, are frightened by the thought of continual spraying and pruning to keep their trees, bushes or vines healthy. They need not be. With one or two seasonal sprayings or dustings, and fungicides mixed with insecticide sprays, the situation can be kept in hand. Of course where the Japanese beetle is prevalent, these pests do love all members of the apple, or rose, family. Pruning annually is necessary, but it is not arduous and can be done in winter and odd moments.

Indeed, little more spraying or pruning is necessary than with ornamental shrubs, especially roses. The point to remember is that you are producing fruit for your own table and not for market. An occasional wormy apple or a bad peach is inevitable. The main thing is to keep the plants healthy and attractive. To be sure, the better care you take of your fruit garden the better crops you will get. They should be fed and cared for the same as the vegetables, flowers, shrubs, shade trees and all the other plants on your place. But you should not let the fear of having to devote a lot of time to your backyard orchard deter you from having one.

Many amateur gardeners, including this one, would no more think of owning a place, even a small city lot, without a fruit tree or two, and a grape vine, than they would think of possessing a house without a lawn or a garage.

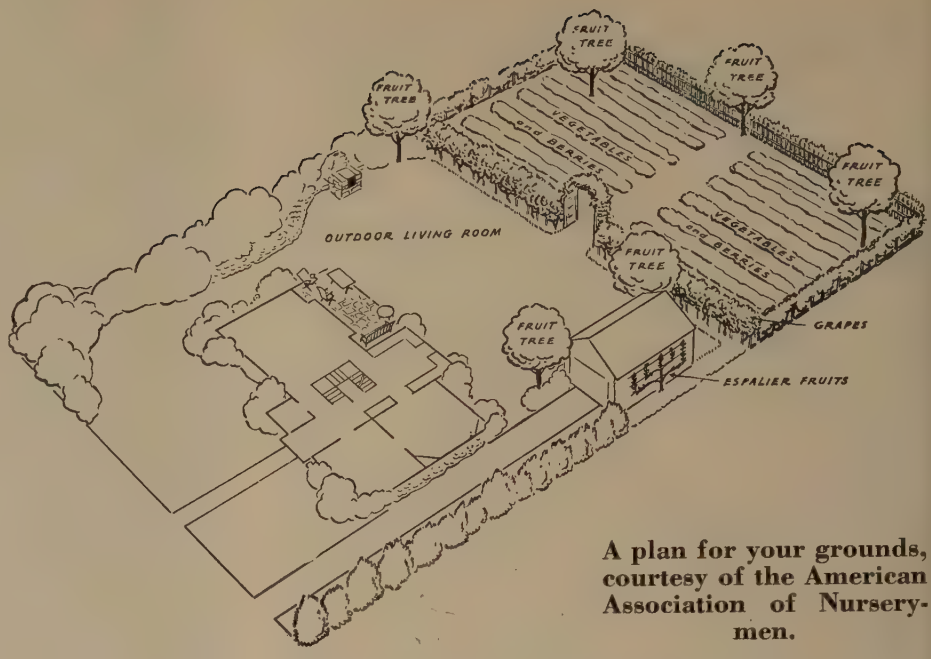
What to plant will naturally depend on your location, on the size of your grounds, and what the family likes. The most practical arrangement—and one that is economical of space as well—is to set aside a portion of your grounds, preferably in the back, for a combination fruit and vegetable garden. The accompanying sketch suggests one way to do this. There can be many variations to suit your taste and the space available. In making a plan it is essential to bear in mind the size to which the different fruits will eventually grow. Apple trees grow the largest and spread out farthest. They are also long-lived trees. Peaches, plums, pears and cherries occupy less space in width although they may grow fairly tall. Peaches are not usually long-lived and are commonly used as fillers. Apple trees are more decorative in shape, too, and are generally considered more appropriate for the living portions of the lawn, or to be seen from the house windows or street.

Home-grown, tree-ripened fruits are richest in sugar and vitamins, and it is a case of beauty and the best in your backyard orchard.

In making up your planting list, choose varieties that are of good quality for the table, or for cooking. If you are going to plant three apple trees, for example, choose an early variety, a fall apple and one that is a good winter-keeper. State agricultural colleges offer free bulletins advising the best varieties to plant for various purposes and for your region. A good nursery catalog will offer suggestions as to planting, cultural directions, and a wealth of varieties to choose from. A peach tree or two, a pear, a cherry

(sour or sweet), and perhaps a plum would be in order if you have the space. Many of the standard varieties also come in dwarf stocks.

At least three or four grape vines might be included and these should be in different varieties, some early and some late. Grapes must always be supported, either on wires or on a trellis. They make a good screen between the lawn and vegetable garden or may be used along the sides of the lot. Currants, gooseberries, and the brambles, such as raspberries and blackberries, are not hard to grow and require only a moderate amount of space. By all means include a strawberry bed. Even a little patch—fifteen feet long and a few rows wide—will produce a large amount of fruit, if properly encouraged, but it will not bear the first year.



A plan for your grounds, courtesy of the American Association of Nurserymen.

Of course, there are many other fruits, such as blueberries, apricots, nectarines and the interesting and exotic things that will grow in Florida, California and other warm climates. The original persimmons are an interesting fruit and make a desirable tree, but are not worth while if you do not like them. An interesting choice would be a nut tree or two, for they are both handsome and productive. There are a number of improved strains of the American walnut, hickory and pecan, and the English walnut will grow in the fairly cold portions of the United States. I would like to suggest for careful consideration the blight-resistant strains of the Chinese chestnut. They make handsome, spreading trees shaped much like the apple, and bear remarkable crops of very good nuts—*if* you get the right varieties. There are nurseries specializing in these and other nut-bearing trees. What could be more fun than harvesting one's own nut crop?

When it comes to planting, most of the fruit trees, bushes and grapes can be planted in the fall in all except the far northern regions. Wherever the climate is suitable, fall planting is better than spring planting in several respects. The stock is freshly-dug and becomes established before the ground freezes hard. Frequently a full season is saved in this manner, and since it may take three or four years for a peach tree to come into bearing, and from six to eight years for an apple to bear fruit, the saving in time is worth while. Grapes, the bush fruits and the brambles begin to work for you sooner than that, but time-saving is an important factor. Strawberries should be set out in the spring.

The large-sized trees will naturally come into bearing sooner, but unless they are of first-grade stock and carefully packed and planted, they may not do as well as younger stock that is easier to move. And the larger sizes, naturally, sell for higher prices.

When setting out a fruit tree, dig a good big hole and spread the roots out carefully. If you have some well-rotted manure or compost put some around the roots, and add a handful of chemical fertilizer too, but mix it in the soil above the roots, *not* in contact with them. Prune your young trees back rather severely, also the grapes and bush fruits, otherwise they will grow up to sprawly shapes. Use a book or bulletin on pruning to get the correct method for each kind of fruit. It is especially important to shape the young trees well in the beginning so that they will have strong forks and not head out too high above the ground. You will want your trees headed low for ease in spraying, pruning and picking. Shapeliness has a great deal to do with the charm and gracefulness of a fruit tree, especially in winter when its bare branches are silhouetted against the sky.

The training of dwarf trees is an art in itself, but one that can be learned by anyone who is willing to take the time and trouble. There are books on this and it is rather fascinating to try, even if one's results are not as finished as those of the professionals. I recall a pear tree that my father trained to a wire frame along the walk leading to the kitchen door. And I once trained a dwarf George Washington cherry tree against the stone wall of our garage. It was doing well until it was accidentally killed during the extermination of termites. Grapes are easy to handle as they are rapid growers and cling to their wire supports with a vise-like grip. The main thing with grapes is to be sure to prune them just enough to keep them under control without sacrificing their fruit buds. Grapes are always borne on buds that are formed on last season's growth, but this is not true of all fruits. Pruning is an art (Continued on page 442)

This is one of a group of practical, how-to-do articles that may be used by adult leaders working with young people, or by the young people themselves. The material that supplies the bases of these articles has all been used effectively by the author as Curator of Education at the Buffalo Museum of Science.

Masks and Nature Lore

By ELLSWORTH JAEGER

AN INTIMATE knowledge of the forest and the forest creatures was a fundamental necessity in the life training of primitive man. Upon this knowledge his very existence depended. The best hunters of the tribes were those most familiar with the habits of the wild creatures. Having only primitive weapons, it was necessary that they be skilled stalkers, and often, in order to approach close to the game, they disguised themselves in animal skins.

At night around the fire, these hunters would often demonstrate in pantomime their hunting and stalking skills, as well as the characteristic movements of the animals. Since animal movement is rhythmic, the animal pantomimes soon became animal dances. Later these dances were thought to confer magic power upon those who participated. Thus the ancient hunting and animal dances came into being. One of the important elements in these dances was that they mimicked the animals with such fidelity and dramatic quality as to be invaluable in teaching the ways of the woodfolk to young and old alike.

Today masked animal dances are not used for good hunting, but they do offer an excellent opportunity to groups of boys and girls for inter-related activities. In addition to physical development, grace of carriage, sense of rhythm and self-expression, children's masked dances provide training in design, color, craft ability, Nature lore and Nature observation. The habits of a chipmunk or a frog become much more important to a child who is to play the part of the animal, to imitate its movements and to make and wear its mask. Many charming legends of the Indian and of Nature can be dramatized with the mask around the council fire or on the school stage. Many entertaining and humorous stories can be made more effective with its help.

Seton's "Animal Dance of Nanabojou" and "The Caribou Dance" in his *Woodland Tales;* Hal Borland's "Coyote Steals the Fire" and a number of other good legends in his *Rocky Mountain Tipi Tales* offer fine material for pantomimic masked dances. The Uncle Remus stories, and Mabel Powers' *Stories the Iroquois Tell Their Children* and *Around an Iroquois Story Fire* also present a wealth of material. Any library can supply a list of books, from which to adapt Nature pantomimes for masking.

The making of the animal masks should be done in the simplest way possible. After experimenting with a number of methods in mask-making, I have come to the conclusion that cardboard cylinder masks

offer the best possible results with a minimum of effort and ability. As the drawings show, a wide variety of masks may be made from the cylinder, using a little ingenuity added to familiarity with the general appearance of the animal.

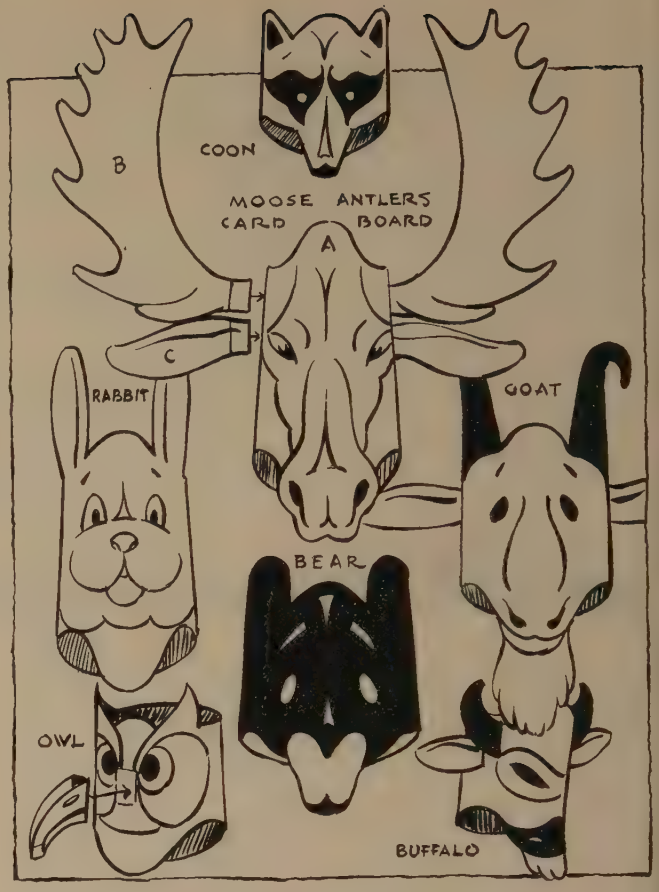
In making the mask, a rectangular piece of cardboard is wrapped about the head to determine the necessary size of the cylinder. A symmetrical drawing of the animal head is then made upon the flat cardboard and painted with opaque show-card colors.

The drawing of the chickadee mask shows the various stages in making. The flat painting (A) shows how the black topknot, black eyes, and black throat patch are painted on the flat cardboard. The base of the cardboard is cut so that the mask will fit over the shoulders when rolled into cylinder shape (B). Beaks, bills, or noses are sometimes made separately and are fastened to the cylinder, either by sewing or with scotch or adhesive tape (C). The mask is then rolled into a cylinder and the overlapped ends fastened together at the back (D).

In such masks as the cat, dog, frog, 'coon, bear, and others there is no projecting nose or beak. In the case of the chick, the beak is made into a cone shape, as that of the chickadee's. The owl's beak, however, is made in one piece and folded on the dotted lines. It is then fastened together at the tip and sewn to the mask.

Sometimes the ears or horns may be cut into the cardboard itself, as in the masks of the rabbit and the bear. The goat's horns are a part of the cylinder, but its ears are cut separately and fastened to the cylinder by means of projecting wings. The antlers and ears of the moose and deer are also cut out separately and fastened to the cylinder. (A, B, and C.)

The mask should be simple in coloring, and symbolic of the animal or bird. Often it will be necessary to exaggerate the coloring a bit. Be sure to simplify all lines and markings, making the mask



more of a design than a realistic painting of the animal head. Try to make each mask a bit humorous.

In mimicking the movements of the animals try to have the children imitate the characteristic postures—the hopping of the frog, the lumbering gait of the bear, or the graceful wings of the wild bird. To do this properly, the children might visit the zoo, or observe the movements of the various common animals in the open. This is excellent training in Nature observation, and it is surprising how much Nature study is involved in a project of this type.

★

Consolation

By CARSTEN AHRENS

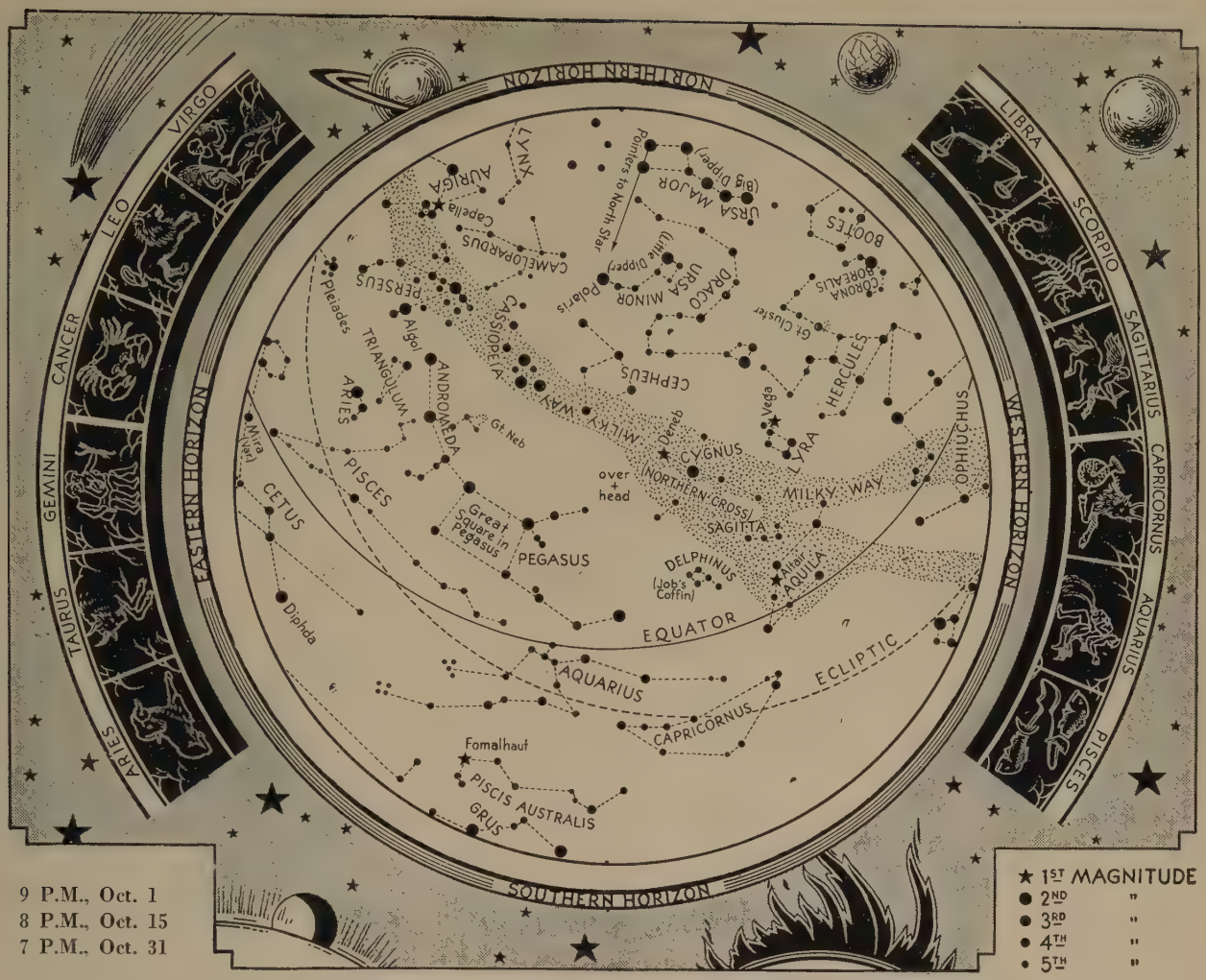
When Mary was six, by the garden wall
She would play by the hour with her jacks and ball.

And then she was taken, left me by myself,
With her jacks scattered over the pantry shelf.

And I used to worry, so tiny was she
To wander alone through Eternity.

But once when the moon was round and high,
And stars were scattered about the sky,

I knew she would use the moon for a ball
And play with jack-stars on heaven's wall.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time; add one hour for War Time.

The Earth's Twin Planet

By ISABEL M. LEWIS

VENUS, which comes closer to the earth than any other planet, has often been called the earth's twin or sister planet. There is little difference in the size of the two bodies. The diameter of Venus is about 7700 miles; the equatorial diameter of the earth is 7927 miles. It follows that the surface area of Venus is only 5 per cent less than the earth's.

Both Venus and the earth are heavy bodies for their size. The density of the earth is greater than that of any other planet, and five and one-half times that of water. This is the *mean* density of the earth. As the density of the outer stony layers is only about one-half the mean density, that of the central core of the earth must be very great compared to that of surface rocks. It is considered probable that the interior of the earth consists of metallic iron, or an alloy of nickel and iron such as is found in the iron meteorites that fall to the earth from space. The density of Venus is nearly as great as that of the earth, or nearly five times that of water, so its interior and surface may be similar to that of the earth. Nothing is known of the surface of the planet for it is concealed from view beneath an impenetrable atmospheric veil. The surface gravity of Venus is 85 per cent of that of the earth, so a man who weighs 180 pounds on the earth would weigh 27 pounds less on Venus.

The existence of a dense atmosphere on Venus has been proved in many ways. When the planet is in the crescent phase, at the time when it is in the part of its orbit nearest to the earth, it has been noted that the cusps of the crescent extend more than half way around the circumference of the disk. At times a thin line of light extends nearly around the circumfer-

ence of the disk when the planet is very nearly in line with earth and sun. This is a result of sunlight shining through the atmosphere of the planet around the dark side of the planet, which is then turned toward us. When Venus transits the face of the sun, it passes directly between the earth and sun and is seen projected against the disk of the sun. This is a rare phenomenon that occurred last in the years 1874 and 1882 and will not occur again until the years 2004 and 2012. At the last transits a thin line of light was observed on the part of the disk that lay beyond the sun, as the transit began and again as it ended. This was produced by refraction of light by the planet's atmosphere and was easily seen with the dark glasses used with the telescope when observing the sun.

The atmosphere of Venus is not only known to exist but has been studied many times with the spectroscope, by means of which the composition of the atmospheres of the planets may be analyzed. In such observations care has to be taken to separate the spectral lines that originate in the earth's atmosphere, known as terrestrial lines, from those of the atmosphere of the planet. The atmosphere of Venus is so opaque, or so filled with clouds, that the part of the atmosphere examined with the spectroscope may be confined to the upper layers only. It has been found from studies of the atmosphere of Venus with the spectroscope that there exist, in these outer strata at least, an abundance of carbon dioxide and a great scarcity of oxygen and water vapor. Both oxygen and water vapor are essential to life as it exists on our own planet. Apparently they are scarce on our sister planet. It is possible that the spectroscope does not show the composition of the layers of atmosphere directly above the surface, and they may differ in some important respects from the outer layers of the atmosphere. The question whether or not life exists on Venus, or in fact upon our other neighboring planet Mars, is one that cannot be answered. There is at present no positive evidence either for or against the existence of life in certain forms upon our two neighboring worlds.

The amount of light and heat that Venus receives from the sun is double the amount that the earth receives from the same source, but the atmosphere of Venus, filled with clouds so dense as effectually to conceal the surface of the planet at all times, may keep much of this light and heat away from the surface. The atmosphere of Venus, in fact, keeps us from finding out many facts that are of great importance in the life of a planet, such as length of its day which is determined by the period of rotation of the planet on its axis, and the nature of its seasons, which depends upon the inclination of the planet's axis of rotation from a position perpendicular to its orbit. The only markings on Venus are hazy and transitory, clearly phenomena of the upper atmosphere. It is impossible to determine from these the time it takes the planet to turn on its axis, or to find the position of the planet's equator and the position of its axis of rotation. This is in great contrast to the atmosphere of Mars, which is so thin that many permanent surface markings are plainly visible. These markings on Mars have given accurate knowledge of the length of the Martian day, which differs little from that of the earth, and of the inclination of the planet's equator to its orbit, which is easily found from observations of these markings and shows that the Martian seasons are similar to our own although twice as long. No such information is available in the case of Venus since the surface is not visible.

There is good reason to believe that the day of Venus is much longer than that of the earth—probably a month or more in length—and that the axis of rotation is very slightly inclined so that there is little if any seasonal change on the planet. It is not probable that the planet keeps the same face always turned toward the sun, as has been at times suggested. If this were so the difference in temperature between the day and night sides would be so great that the uniform temperature observed in the upper atmosphere could not be maintained.

When one considers the great difference that probably exists between the two planets Earth and Venus in such important matters as seasonal changes and length of day, as well as in the composition of their atmospheres, one wonders if after all these two planets should be called twin or sister planets. In size, density and surface gravity they are, indeed, similar, as well as in the fact that they both possess dense atmospheres, but there the resemblance may cease.

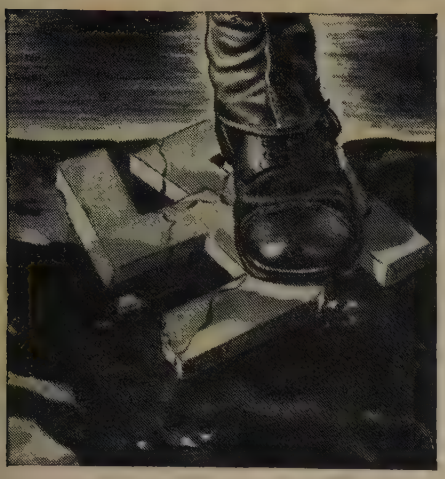
Viewed from the earth Venus is by far the most brilliant of all the planets, and in the telescope it shows phases like those of the moon because its orbit lies between the sun and the earth's orbit. When it is nearest the earth at inferior conjunction its phase is that of new moon. It is then at a distance of about 26,000,000 miles from the earth. No body in the solar system comes closer to the earth, except the moon and a few comets and asteroids. At superior conjunction, when it is farthest from the earth, its phase is that of the full (Continued on page 441)

Dusk in the Planetarium

By MARCUS Z. LYTLE

The daylight fades. A ruddy sunset band
Has turned to blue beyond the palisade;
The tumbled contours of the hilly land
Seem real and not a picture man has made.
Like summer breezes from the brushy hills
The air is fanning softly on my face.
The stars awaken; noble music stills
The sanctum of a holy inner place.

HASTEN



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HEAD-CARRYING ANTS

By RALPH W. DEXTER

On July 6, 1944, an ant that at first appeared to possess three distinct heads was brought to the writer at Kent State University. Examination under the binocular microscope disclosed that one ant had the heads of two others firmly attached to its antennae. One head was fastened to the base of each antennae by the mandibles of the decapitated heads. Apparently two of the ants attacked the third, which then beheaded its attackers, but not before they had secured a death-grip on the antennae as described. The weight of these heads seemed to burden their carrier, which tried repeatedly to push them off with its forelegs. Finally, one head was loosened and worked off the antennae. The other was still attached when the ant was killed and preserved a day later. Dr. Neal A. Weber of the University of North Dakota identified it, and the two heads, as *Camponotus herculaneus pennsylvanicus*, the black carpenter ant. The specimens were collected from a yard in Kent, Ohio. Dr. Weber has seen and reported similar head-carrying activities by ants in Africa and South America. At times the heads found on the antennae of one ant belong to a rival species, but other times the victims are of the same species as the head-carrier.

Out of the Past

Leafing over some old almanacs in the collection of her father, Deborah Davis of Boise, Idaho, came across one for 1844. In it she found a comment on the passenger pigeon of by-gone days that is worthy of record, if only to show again what man did to one bird species. The item quotes the *Miners' Express* of Dubuque, Iowa, and says:

"A Mr. McDowell came to our office yesterday, and told us that there is an immense pigeon roost in the forks of the Maquoketa, in Jackson County, such as has never been seen in this country before—it is three miles long, and a half mile in width. There can be no estimate made of their numbers. Their roosting places are about a mile distant from their nests and feeding places, being three in number, and each one covering a section of land—and they darken the air with their number and break young trees with their weight, and hundreds are killed by getting entangled in the falling limbs and branches. The people kill them with clubs, and their noise is so loud that when a gun is fired amongst them, the report cannot be heard—and a person can stand in one spot and shoot all day, the birds returning as soon as you can load. They are building their nests, and the people are alarmed, lest they may destroy their crops."

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The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

CEREALS IN SCHOOL

THERE was a time, not so long ago, when high school botany lessons supplied about the only school consideration of cereals. Then, the studies were concerned primarily with the morphology of the plant and fruit of some cereal, or with the physiology associated with the germination process. High school botany students drew pictures of the fruit of corn and labelled it as though it were a seed. It was an era in which the doctrine of formal discipline held that ancient languages, mathematics and logic supplied all the essential disciplines one needed from the school experience.

In those calm days our practical interest in the cereals was for the most part concerned with raising them to provide food for beasts, and food and drink for man. If we could not profitably find consumers for our surplus grain crops, we either burned the stuff in furnaces to keep us warm or dumped it by the wayside. It does not seem likely that those days will return in the relatively near future. This is not because we are not likely to raise more cereals than we and our domestic animals can eat, because we probably will. Rather, it is because of the tremendously wide variety of new uses of these materials that now appears on the horizon. And with those new horizons, it seems only sensible that the schools look with a new vision on these significant objective parts of our environment.

Lore of Corn

I well remember one of my earliest teaching experiences, when I came fresh from an eastern university to teach botany to youths who came even more recently from the Iowa farms. I tried to feed them a lingo of technical terms that had no significance to them. They came back after week ends at home and asked me point blank which of two ears of corn should be saved for seed next year. We struck a happy bargain, and I am sure that I learned more than they did, but I am equally certain that none of the lore of corn I learned that first year would then have been recognized as valuable by those high in science education. I am not sure that it would be so recognized now. But I am sure that it provided more suitable educational activities for those I was teaching than anything I ever saw in a state regents' examination, or in a college entrance list of questions.

But what has all of this to do with the present? Simply this. Where a few years ago the farmers who were the great producers of wealth from organisms were concerned with producing cereals primarily for food, now they will be seeking cereals rating high because of other characteristics. We may seek fiber in some of these plants. We undoubtedly will seek the raw materials for fuels and plastics in many of them. And the insatiable appetite of a vigorous civilization, recovering from a "bender" of a decade of war, will demand that most of us have things that were not even dreamed of by earlier generations. Since many of the youngsters now in our precollege schools will be taking the lead in this more sensible use of human energies, it behooves those who now teach them to do something to prepare them for that activity.

In the insert section of this issue of *Nature Magazine*, I have given some consideration to some of the new uses that may be expected of the cereal plants. I have also, in the chart section of that insert, given some of the details important to the culture and improvement of some of the more important species. Now, how can these materials be made significant in the schools?

Significance of Cereals

We must recognize the basic significance of cereals as food, of course. We are told over the radio of the superior nutritive values of "cornies," or of some other "cerealies." While we recognize that much of the patter is "corn," nevertheless, if it is repeated often enough, we begin to have some faith in what we are told. But can we learn anything about this through direct experience? Make a collection of the fruits of as many cereals as possible. See if you can distinguish any differences in them through their taste, dry. Put a representative collection of corn, wheat, oats, barley and rye to soak in cups for a few days, and then taste them to see if they have developed more remarkable differences than were evident in working with the dry kernels.

Try the different grains available to see if other animals show any preference for any of them. Try birds at the feeding station, poultry in the chicken coop, horses, rabbits, guinea pigs and any other animals available. Try using crushed oats, corn, barley and other cereals as baits for mice to see if one or the other seems to be more attractive. You probably will not be able to reach any phenomenal conclusions but you will be doing something more valuable than the standard studies of these plants a few years ago. If you must recommend some supplementary reading in this field see how Paul DeKruif's *Hunger Fighters* meets your needs.

Try Various Tests

But now let us look for other things in these plants we have used so much as food. Set to work to see what happens to them when they are exposed to heat. Do they become hard or soft? Do they explode if they are dry—or if they are relatively moist —when they are exposed to heat? When they do change, do all the parts become equally hard or equally soft? Do any become slippery, slimy or greasy? Do they change color? After they have been treated by heat, do they seem to be more palatable or less so? Any number of things worth doing may suggest themselves to students with any reasonable amount of science talent. Try treating various cereals, or the stems or other parts of cereal plants, with various chemicals to see what happens; what color changes take place; whether they form hard substances or soft substances; whether they become gummy or slippery, brittle or elastic, heavy or light in weight. Any new use that may be recognized for any of these products might conceivably be important for all those who raise cereal plants for a living. Raising them for food only will never again be enough to provide a complete living for those who make their living from the soil.

A recent children's encyclopedia devotes a whole page to the means by which plants are pollinated. It tells of wind pollination and of insect pollination, but it makes no mention of the self-pollination techniques so significant with some cereal plants. Think what a difference it would make to maintaining valuable strains of wheat if pollination were always dependent on insects and wind. With those that are self-pollinated, however, there is little difficulty in maintaining a strain that can survive in different conditions of soil, moisture, light, and length of growing season. The plant hunting globe trotters who have gone to the ends of the earth to find something that would be best for a particular situation have not exhausted the possibilities of the future.

Teachers must begin to think along lines not found in the current texts. Only recently, I talked with a teacher who has an enviable record in "getting students through" their exams, but when he was questioned about some of the applications of what he found in his texts he was hopelessly lost, even though the newspapers were full of significant material. He knew much of the standard mechanics involved in Mendelian inheritance but had no appreciation of the significance of strains or breeds, nor could he "see much to this hybrid corn business" about

which he had heard so much.

What I have been trying to say in all this is that our appreciation of the varied significance of the different cereals is increasing at such a rapid rate that no teacher has any right to continue indefinitely teaching the same old stuff that was standard during normal school or teachers' college days. The public must get a finer appreciation of the nutritive value of cereals and of cereal products, of the importance of inheritance, germination possibilities and culture requirements of cereals used in planting, and of the widely expanding new uses to which old cereal products are being put. Any teacher not willing to make the effort to keep posted in these fields has no right to be pleased with himself no matter how many of his students can pass the standard "parrot type" of examinations so popular with some "educators."

THE EARTH'S TWIN PLANET

(Continued from page 438)

moon and its distance is 160,000,000 miles. It is then least brilliant but still bright enough to outshine any other planet. At times of eastern and western elongations the planet shows the phase of a half-moon, and its angular distance from the sun is then greatest but cannot at most exceed 48 degrees. About 36 days before and after the time of inferior conjunction with the sun, when the planet is in the crescent phase, and resembles the five-day-old moon, it has its greatest brilliancy and is then about two and one-half times brighter than it is at superior conjunction, the time when it is least brilliant. The orbit of Venus is more nearly circular than that of any other planet, the variation in distance being less than 1,000,000 miles. So there is little change in the amount of radiation received from the sun in different parts of its orbit.

It takes the planet only 225 days to make one trip around the sun but the interval from any one phase back to the same phase is 584 days.

It takes 220 days for the planet to pass from western elongation to superior conjunction—all of which time it is in the gibbous phase—and another 220 days to pass from superior conjunction to eastern elongation, when it is also in the gibbous phase but in the evening instead of morning sky. As the total interval is 440 days the planet may be seen in the gibbous phase for more than one year with no periods of greatest brilliancy and no elongations. That happens in 1944. It takes 72 days for Venus to pass from eastern elongation to inferior conjunction, and an equal period from inferior conjunction to western elongation. During this period it is in the crescent phase and its times of greatest brilliancy occur 36 days either side of inferior conjunction.

In October Venus will be seen low in the West at sunset, and will set about one and one-half hours after the sun. Mercury may be glimpsed for a few days the first of the month in the morning sky. It passes to the evening sky on October 20 at superior conjunction, but will not be visible again during the month. Mars is drawing close to the sun in the evening sky in Virgo. Jupiter is in the morning sky and is a brilliant object in the southeastern sky, rising three hours before the sun. Saturn is in Virgo and now rises about an hour before midnight and will soon be a fine object in the evening sky.

Education Week

"Education for New Tasks" will be the theme of the twenty-fourth annual observance of American Education Week, November 5 to 11. As in the past topics have been chosen for each day. Starting with Sunday, November 5, they are: "Building Worldwide Brotherhood," "Winning the War," "Improving Schools for Tomorrow," "Developing an Enduring Peace," "Preparing for the New Technology," "Educating All the People" and "Bettering Community Life." The National Education Association, 1201 16th Street, N.W., Washington 6, D. C., has prepared a variety of materials to aid local schools in the observance.

Conservation Call

"Poverty or Conservation Your National Problem." By Jay N. ("Ding") Darling. Washington, D. C. 1944. National Wildlife Federation. 30 pages. 10 cents.

In this excellent booklet "Ding" Darling takes an objective look at the conservation movement, how far it has come, what it means, and why it has not accomplished more than it has. "After all these years of effort to find some formula of conservation which would work," he says, "I am convinced that until a new generation is taught in the public schools man's utter dependence on natural resources; until the teachers of Botany, Chemistry, Biology and Geology emphasize the function rather than the terminology of their respective sciences; until in fact we have a majority of the American public schooled in the fundamental principles of conservation, criminal waste will continue to reduce our heritage of natural resources. If you will begin to work soon on the youth now in the grade schools, it will not be too awfully late. To me, education has become the only pathway that can lead us out of the doldrums."

With his faculty for graphic expression, "Ding" sounds a warning of disaster and a call for action. This is a pamphlet that should be widely read and reread; it should—and, indeed, must—inspire action.

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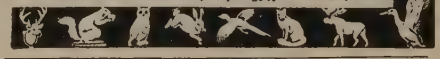

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CURIOUS NUDIBRANCH

By JOEL W. HEDGPETH

While many animals make use of their fellow creatures — ants enslave aphids, the pilot fish hitch hikes on some easy-going shark, and hermit crabs preempt the shells of hapless snails. —there is but one known example of an animal appropriating an *organ* of another animal for its own use.

This is done by the members of a family of nudibranchs — sea slugs — who feed on sea anemones and hydroids. These creatures on which the slugs feed possess offensive and protective devices known as nematocysts, which are minute stinging cells. A small creature swimming within reach of a hydroid or anemone is paralyzed instantly by these stinging cells, but the sea slug relishes them. It would seem to us that they must taste like tobasco sauce—evidently the sea slug likes its food highly seasoned, however. In some manner not completely understood, these nematocysts find their way into the finger like processes, or cerata, along the back of the sea slug, and are finally gathered in a little pocket at the tip of the process. Here they serve to protect the sea slug from its enemies, for although the nudibranch has no direct control over its borrowed stingers, it may, by contracting its body and thus exerting pressure on the storage cells, force the nematocysts packed in them to send out their stinging hairs almost as effectively as if they were still in the original owner.

These nudibranchs with the queer appetites belong to the family Aeolididae, and are common along most seacoasts. Like most of their kind, they are often vividly colored. *Flabellina,* a denizen of the California coast, has a purple body and bright orange processes on its back.

BACKYARD ORCHARD

(Continued from page 434)

as well as a science. but easily mastered.

So do not be frightened by demands of a backyard orchard. It is fun to have one and the relatively little work involved is worth while, particularly when you sit down to a bowl of sliced peaches from your tree, or munch a home-grown apple. Fruits store up sugar rapidly during the last few days on the tree, and home-grown and tree-ripened fruits are thus tastier and richer in vitamins. So it is a case of beauty and the best in your backyard orchard.

Left Its Mark

One morning Mrs. Violet B. Mautner, Santa Barbara, California, bird lover, noticed a large mark on a window pane. Closer examination proved it to be the outline of a bird. It was a second-floor window, so Mrs. Mautner went downstairs and outside, certain that the bird must have been killed in crashing against the window. There was no sign of the bird.

After several days the mark became more distinct, probably from the accumulation of dust. With morning light shining on it it was particularly distinct, so Mrs. Mautner snapped the picture above. She did not take the measurements of the mark, but it was apparently made by a large bird, a gull, she feels.

Bird Nests Wanted

Among her many activities, Mrs. J. Frank Key of Buena Vista, Virginia, gives free courses in bird study to boys and girls in schools and camps. This work is carried on in her capacity as Associate Chairman for Birds of the National Council of State Garden Clubs. For use in connection with her work Mrs. Key would like very much to have some bird nests, identified as to the species that occupied them. She would appreciate any help that other bird enthusiasts could give her.

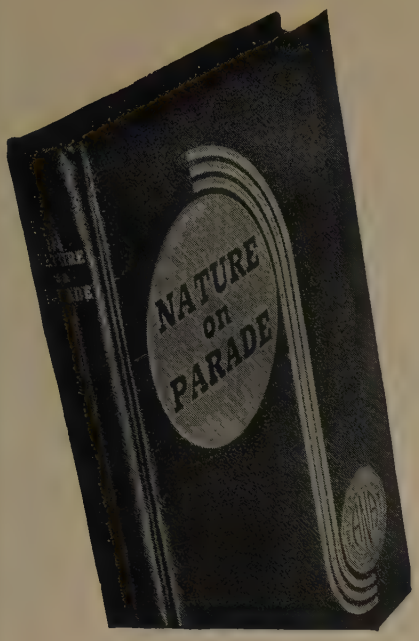
Aussie Pigeons

Pigeons are now carrying between 7000 and 8000 messages a month in the Southwest Pacific, according to an announcement by the Australian Army Pigeon Service. The service has become so important that all Australian troops are instructed in the use of the birds. Small vessels without radio, as well as larger ones not wishing to break radio silence, use pigeons for communication. During the early stage of the New Britain landing an Australian survey patrol found itself 24 miles from its base, where it sighted a body of enemy troops. A pigeon took back a message in 22 minutes, and the enemy position was heavily bombed, breaking up a Jap counter-attack.

Poisonous Snakes

Poisonous Snakes of the Eastern United States with First Aid Guide. By Harry T. Davis and C. S. Brimley. Raleigh, N. C. 1944. North Carolina State Museum. 16 pages. Illustrated, including 4 color plates. Available from the North Carolina Bird Club, Box 2281, Raleigh, N. C., for ten cents.

This is a valuable little pamphlet dealing with the eight eastern poisonous snakes—the coral snake, five rattlesnakes and two moccasins. The information about each snake covers its distribution, description and habits. The illustrations are valuable in aiding identification. Two pages, with illustrations, give instructions on first aid in treating snake bite.



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Defeat This Bill!

One of the most serious menaces to the integrity of our National Park system is contained in H.R.5058, introduced by Clair Engle, Congressman from California. This bill would make mandatory the opening of all national parks and monuments to grazing of livestock, irrespective of existing laws or policies. The proposal is made under the guise of increasing food production, but actually is a dangerous entering wedge for breaking down the protection that has been thrown about the parks and monuments. This protection has been regarded with jealousy by many interests wishing to exploit these areas for private profit and at the expense of all Americans, in whose interests the parks and monuments have been set aside.

With negligible contribution to the national food supply, several national parks were opened to grazing during World War I. The damage in pollution, soil erosion, and to installations was serious, and it took ten years to get the grazers out of the parks once they had gotten in. As a contribution to this war, limited grazing permits have been issued in marginal park areas, while grazing rights that existed before some of the lands were taken into the parks are still exercised. Still, pressure comes from the livestock interests, although, for example, range surveys show that the carrying capacity of the range in California National Parks would not accommodate more than 6000 head, which is one-half of one percent of the beef cattle in the State.

This proposed bill—H.R. 5058—represents ulterior motives, ignorance of the facts and an hysterical failure to recognize values. It is dangerous in precedent and practice. Its contribution to winning the war is infinitesimal in itself, and its effect would be disastrous. This bill should be defeated.

SEA LIONS

By **JOEL W. HEDGPETH**

In California they are after the sea lions again. Our favorite fish and game columnist, whose morning column can usually start us off for the day in a fighting mood, is leading the hue and cry. "The sea lions should be reduced to a harmless handful; they are destroying tons of fish we need for wartime food and which provide sport and recreation for tired war workers," is the substance of his remarks.

Of course, it cannot be denied that sea lions eat fish, but this is an old story. Back in 1874, when California had just established a Fish Commission, one of that Commission's first official actions was to recommend that nine-tenths of the sea lions be shot and their carcasses reduced to lubricating oil, because the salmon were getting scarce. Some years

(Continued on Page 445)

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DESERT DISCOVERIES

(Continued from page 404)

richly marked with maroon and glossy green, viewed against glimpses of tall saguaro, menacing cane cactus, and golden cholla on black *malpais* slopes beyond, were a more than common discovery. This experience only the desert, conjuring with far oases, ephemeral rivers and fantastic cactus "gardens" could have achieved for the intrigued lover of the outdoors.

We are accustomed to color in the desert's glowing canyon walls; its delicate flowers, its primitive peoples. But the earth-coloring of Death Valley will always be a discovery to each one who beholds it.

Breaking through the somber Funerals, along the chaotic course of Furnace Creek, you come to the golden badlands at the base of Black Range. Below its dark spine, weirdly scattering their light pastels beyond in patchwork up its higher slopes, golden hills rise in creamy convolutions. There is a maze of creviced washes here that might easily craze the traveler afoot. If caught at glaring midday, where yellow, blue and black are insanely splashed upon dry mud slopes and exhausted, burned-out rock, he might soon be thinking madly. If you zigzagged, thirst-crazed, down the deepest *barranca*, between lurching walls, under carved mud bridges, it would be to emerge as spewed, perhaps raving wreckage upon the appalling Valley floor. It was like that before roads came. "We bury a few of 'em yet that gets lost in the Valley," an old timer imparted.

From the black ribbon of highway leading south to Salt Springs, you may explore Volcanic and Artist's Drives. The amazing, pinto-patterned slopes swallow you quickly. The track insinuates itself up black washes to squeeze through tight canyons where diabolic forces must still be at work. Kaleidoscopic View brings you to the scorched mountain wall. The earth here is as vividly daubed with contrasting colors as though it had served as palette for some satanic artist. Rare sky blue, umber, Indian red, chocolate, blue-gray, cadmium and chrome decorate the sun-baked slope. Canyons of ochre and cream lead on until, at the end, the descent back to the heat-cursed valley-sink seems a return to reality.

It was after midnight in Death Valley when I made one of my most memorable discoveries in the desert. The May moon was low, sinking rapidly behind the black Panamints. A mysterious crackling had awakened me, coming from velvety shadows beneath the nearby mesquite trees. As I reached for my flashlight, the hot night wind rustled their brittle bean-pods across the car top; but this was not the sound I had heard.

The swift beam of the flash darted hastily after an elusive shadow slipping away among twisted trunks of the mesquite grove. I had but a glimpse of the nocturnal visitor. Still I knew that imagination had not pictured that nebulous shape there in the shadows. It was a kit fox!

He had carried away and had been licking and rattling a parchment-dry butter wrapper left on the table. He might return another night!

The camera and I were waiting expectantly when the moon rose again, coppery-red above the somber Funerals. There was no other camper at Furnace Creek. Surely the phantom fox would come again, wraith-like in the moonlight; and I tautened the twenty-foot thread that ran from the car window to trip the synchro-flash and the impatient shutter. Tempting bait was hidden out there against the rough back of a boulder.

Yet for an hour, then two, the light grew brighter, the mesquite shadows blacker. No distinct shape resolved from the creosote bushes. No ghostly form materialized in the shadows. Sleep was drugging me into unconsciousness.

Suddenly, silently, something moved into the filmy flood of the moon! It loped toward the camera. It was a jack rabbit. Leisurely the jack hopped off into the creosote. It paused, a dark blotch, strangely alert. Sensing the thing eerily, I too was aware that the swift fox had glided like a gray ghost into the moonglow. He drifted, silent-footed, before the camera. Tensing the thread, I followed every shadowy movement.

At last, with great ears sharp and luminous eyes watching, the kit studied the camera. Instantly, at a jerk, the mesquite grove and the diminutive fox vanished in the dazzling radiance of midday. Then as swiftly it was blindingly dark. But the film had glimpsed the phantom of the desert. It would not forget.

There will always be mysteries out there in the desert. What forgotten cliff-city waits in the painted maze of its fathomless canyons? What fabulous flower blooms beyond in the haze-smoke of its far, tawny mesas? What secrets lie hidden atop the last purple *cima?* These are the discoveries of the desert.

Source Material

Two extremely useful compilations of references to source material come to us from the New Jersey State Teachers College, Upper Montclair, New Jersey. One of these is a 43-page mimeographed booklet listing audio-visual and teaching aids in the field of Science. It is compiled by George E. Flimlin from material collected by Lili Heimers, and covers Nature study, physics, science in farm and garden, science in industry, science in the home and science in warfare. The second compilation is in the field of Recreation, the work being done by Lili Heimers. Both are edited by Margaret G. Cook, librarian at the college. *Science* sells for seventy-five cents; *Recreation* for $1.00.

Why It Is Red

In recent correspondence with Mrs. Lila Ripley Barnwell of Hendersonville, North Carolina, about the State Bird of North Carolina—now finally and officially the cardinal—we observed that it was, in our opinion, rather unfortunate that a bird already the official bird of Illinois, Kentucky and Ohio had been chosen. Mrs. Barnwell responded with a story that she felt justified the selection for North Carolina.

Pointing out that the Eastern Band of the Cherokee Nation lives in the State, she cites a legend of the Cherokees about the cardinal. After the flood, it seems, everything was wet, cold and disagreeable. Fire could be obtained only from heaven, but man and animals had no wings to go fetch it. So the birds offered to try. One after another flew upward, but returned unsuccessful. Finally a gray bird offered to try. It was gone a long time, but when it returned its entire body was a flaming red, except for some black about its tortured eyes. Even its bill had been serrated by live fire. Ever since that memorable day the gray bird has kept its red color, black marking and serrated bill. The Cherokees call it the "fire bird." We know it as the cardinal.

War Studies

So popular have been the Smithsonian War Background Studies that it is no longer possible to continue printing copies for unrestricted free distribution. The entire cost of the series has thus far been defrayed by private funds of the Institution, but money for a further free edition is no longer available. It has been decided, therefore, to bring out new editions for sale, on a non-profit basis, to individuals. The smaller papers —Nos. 2, 3, 5, 8, 12 and 17—will be sold for ten cents a copy; all others for 25 cents per copy. This is an exceedingly modest price for these outstanding booklets, which were reviewed in *Nature Magazine* for March, 1944. Remittances should be sent with orders to Smithsonian Institution, Washington 25, D. C.

Schlich Forestry Medal

At a meeting of the Washington Section, Society of American Foresters, Henry S. Graves, dean emeritus of the Yale School of Forestry, was awarded the Sir William Schlich medal for distinguished service to American forestry. The award was established to perpetuate the memory of the man who established the forest service in India and who served as professor of forestry at Oxford University. Only twice before has it been awarded in the United States, first, to President Roosevelt for his leadership in the forest conservation movement, and, second, to Gifford Pinchot, the first chief of the U. S. Forest Service.

SEA LIONS

(Continued from Page 443)

later, an investigation was made of the food and population of the sea lions, but as far as the scientists could determine, the quantities of commercially important fish eaten by the animals were insignificant. Now the story is that the sea lion population has increased of late, and therefore the animals are eating more fish. The fish are getting scarcer in San Francisco Bay, they argue. And what more obvious cause of this decline than the horde of sea lions off the Golden Gate? Therefore, let us kill off most of the sea lions—nobody cares about them anyhow—and then we will have more salmon and striped bass in the bay.

Let us say we exterminate the sea lions, not even leaving a polite remnant for the sake of the Nature lovers. The fish will still be on the decline, especially when the effects of the big dams being built in California's streams catch up with the salmon runs and the irrigation ditches disrupt the bass spawning grounds. We will have no sea lions left on which to blame the decrease. And, because of the fantastic price of shark livers, there will be precious few sharks of any kind left in the ocean to blame. Then what shall we exterminate to save the fish? The inference, we are afraid, is obvious. We will have to exterminate ourselves. For it is not the sea lions that have increased to vast destroying hordes, but ourselves. The statisticians are not in agreement over the precise figures and percentages, but all agree that California has practically doubled its human population in the last few years, especially in the San Francisco Bay region.

But the day of miracles is past; we cannot multiply our fishes to feed this multitude. If everybody is to have the same amount of fish they did before the war boom, that would mean that twice as many fish would have to be caught as were taken before all these people came out to work for Mr. Kaiser. But since the fish population must depend on its own reproduction, rather than on mass migrations from other parts of the ocean, to maintain itself, its rate of increase, if any, has no relation to the potential human consumers. If we grant, for the sake of the argument, that the pre-war consumption of fish was adjusted to the natural reproductive capacity of this fish (which it probably was not), there is but one answer. If we want the fish to go around, we must expect to eat half as many as we did before, for to double the catch would be the end of the fish population. This is the sort of thing conservationists have been trying to drive home for years, but it is too unpalatable for those who want to eat or catch their fish and have them, too. So it is much easier to blame anything but ourselves for the decline of the fish and the destruction of other natural resources.

Fortunately, because of wartime restrictions, use of boats by the Navy and other factors, we have not yet succeeded in doubling our catch of fish, and the discovery that there may not be enough to go around at the old rate has not percolated into the mind of the general public. It only seems that something else is eating up *our* fish, so we blame the sea lions.

Bartram's Travels

William Bartram—Travels in Georgia and Florida, 1773-4; A Report to Dr. John Fothergill. Annotated by Francis Harper. Philadelphia. 1944. The American Philosophical Society. Illustrated. 121 pages.

This is a companion volume to *John Bartram's Diary, July 1765-April 1766,* reviewed in *Nature Magazine* for August-September, 1943, and in which the father and his young son, William, traveled in the Carolinas, Georgia and Florida. In his study and interpreting of William Bartram's report to his patron, Dr. John Fothergill, who had requested that the journey be made, and who had financed the undertaking, Dr. Harper has spared no pains to learn what species of plant or animal were referred to by the traveler, although these efforts have not always been successful. The wealth of Bartram's observations, and the care that Dr. Harper has devoted to the work, are both exemplified by the details of the editor's annotated index. This feature is followed by literature cited and a list of maps and atlases. Finally is the general index in which each person involved has a place, along with each species of plant and animal. Maps of the period, modern photographs of scenery and reproduction of the more interesting plants and animals add greatly to the interest of the work.

The Bartram Journals, Parts 1 and 2, are printed to be bound together, and are continuously paged. The combined volume, bound in cloth, is five dollars; the separate parts, in paper, are two dollars each. They are of absorbing interest to those who value the history of American science. E.A.P.

Physics Today

Physics of the 20th Century. By Pascual Jordan. New York. 1944. The Philosophical Library. 185 pages. $4.00.

In popular terms, this book presents an analytical discussion of physics and its growth and relation to cosmic and biological process from Galileo down to the theories of today. It is interpretive history of the development of physical knowledge from the classical Galilean-Newtonian mechanics down to the microphysics and macrophysics of atoms, electrons and quanta.

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Under the Microscope

By JULIAN D. CORRINGTON

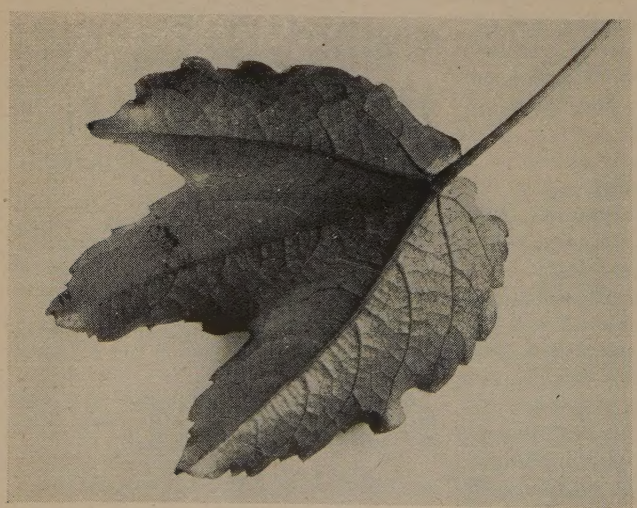
PHOTOMACROGRAPHS

The title for our principal subject, as we begin the eighth year of this Department, is a word so new that it does not appear in our Webster. Yet, in this form, or simply macrograph, or the abbreviated photomacro, it is in current and common usage by all technologists and in every industrial and scientific laboratory. The word is one of those handy, coined affairs which Americans, especially, are prone to manufacture when the need arises, and stems from photomicrograph; it means a photograph of life size or low magnification, from 1X to some 15X; a low-power photomicrograph of a relatively large object, made without the use of a compound microscope. Photomacrographs are especially desirable in studies on embryos, parasites, insects, seeds, leaves, entire small (yet not microscopic) organisms, small manufactured articles, engravings, minerals, crystals in general, metals and fractures therein, and a host of other subjects for which low magnification suffices.

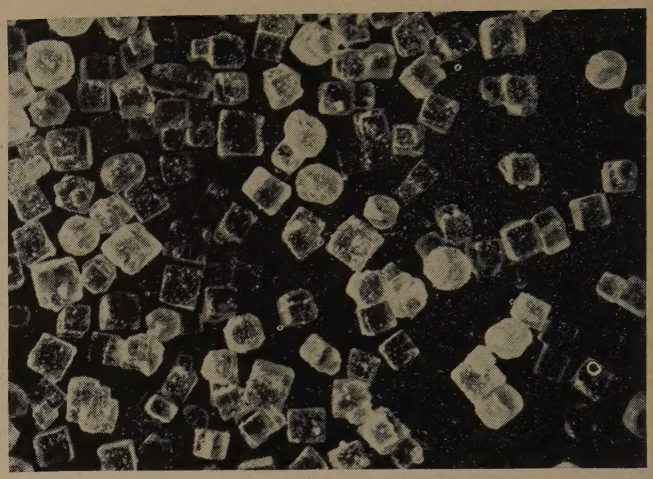
Just as regulation photomicrography differs from ordinary photography and has techniques and problems all its own, so macrography poses certain puzzles that the beginner must solve before his work will be first class. Most technicians will tell you that the average high-power shot of a stained thin section has mainly the matter of color filters and of length of exposure as difficulties and that it is a cinch alongside a 5X picture of an entire insect. Here, not only do we have exposure time, but two other and harder factors—depth of focus and incident illumination.

We have seen some very good pictures made through hand lenses, and this method is well worth trying. Likewise it is not too difficult to make a holder for a positive spectacle lens and place this in front of the camera lens to shorten the focus and give low magnification. However, anyone who wishes to do serious work in this field and make a real study of the subject should own a suitable camera in the first place, and purchase several special lenses from time to time as growing needs will dictate. A portrait camera or any model equipped with a bellows is best.

Lenses for macrography should be well-corrected anastigmats with focal lengths from 16 or 20 mm. up to 4-inch and 6-inch



Photomacrograph of ivy leaf.



Photomacrograph of salt crystals.

(100, 150 mm.). Ciné cameras and miniature 35-mm.-film cameras have lenses within this range. Covering power and depth of focus are the criteria desired, not speed, hence lenses of aperture such as *F*: 4.5 are sufficient, even better for this work, than faster ones.

If an ordinary lens of one of these cameras is used it should, if possible, be turned around to obtain best results; that is, since the lens is to be used for magnification, the normal front surface should be turned toward the inside of the camera and the rear of the lens toward the object.

Short-focus lenses that will make photographs at closer range than the ten inches of best vision of the unaided eye will give a low order of magnification. They are threaded to screw directly on the front of a camera, and, by means of an adapter, can also be screwed to the nosepiece of a compound microscope. Such lenses have various trade names, as microtessar (Bausch & Lomb), micro-teleplat (Spencer), argus (Watson), microstigmar (Beck), and micro-summar (Leitz). Less complex in design as well as having a lower N.A. than microscope objectives, these macrographic lenses have a flatter field, excellent definition, and are superior for the purposes for which intended. Many of them are equipped with their own iris diaphragm, to control depth of focus, and for most of them special matching condensers are available for critical work using transmitted light. Generally they are attached directly to the camera, but may be mounted on the tube or nosepiece of a compound microscope; in such a case the microscope serves merely as a convenient mount or stand; the eye-piece is removed, hence dispensing with all optical parts of the instrument.

Some small cameras have extension tubes as an accessory, and with these the effect of a long bellows draw can be obtained, permitting low magnification with proper depth of focus.

As in most photographic work, illumination is the major factor to consider. However, instead of the questions of color and an intense, focused beam, as in high-power, thin-section photomicrography, the problem here is much the same as in portrait work, but on a miniature scale. Desirable qualities are highlighting and relief, with shadows in some cases, uniform brilliance in others, to bring out contour and texture.

The higher the magnification the shorter the working distance; that is, the clearance between object and lens. Most subjects call for incident lighting—reflected light from above—and to get this light in upon the object when the lens is generally close to and directly above it, frequently makes demands on the ingenuity of the operator. For relatively large material with rather obvious characteristics, flat lighting is satisfactory, but in the case of smaller subjects that present only a slight variation in surface and contour, a careful adjustment of the illumination will be required to bring out the texture and modeling.

A variety of light sources are available. The gooseneck desk

Photomacrograph of the huge compound eyes of a house fly.

lamp, fitted with a 100-watt frosted bulb, suffices for the larger work where the distance between object and lens is great enough to accommodate such a lamp. For shorter working distances, miniature spot lamps of several forms may be purchased or made. The 6- to 8-volt auto headlight bulbs of 32 to 50 candlepower, operating on a transformer, can be rigged in a reflector or a metal tube. For example: support such a bulb in its socket by any form of stand and clamp that is at hand; attach to this socket a parabolic metal reflector, coated on its inner surface with white or aluminum paint, and adjust squarely over the object. A circular opening cut in the top center of this reflector is aligned immediately under the camera lens. The usual reflector of the gooseneck lamp can be used for this purpose by adapting the attachment and cutting the hole for the lens.

A ring of small bulbs, as those for flashlights, may be hooked together in parallel in a circular trough to provide a satisfactory homemade substitute for the expensive commercial ring illuminant. The device is so attached that the camera lens projects through the center of the ring, light falling evenly from above on all sides of the object. Many forms of microscope lamps may be employed; if 100-watt, 110-volt bulbs are used, a ground glass is necessary to break up the image of the filament, but in the case of a 6-volt, 18-amp. ribbon-filament lamp, a condenser lens can usually be set so as to throw a fairly even beam on the material. The front end of a small, cheap flashlight can be screwed to a wooden block holder of suitable size and the receptacle wired to the house current through a transformer, discarding the batteries.

In working with any of the small spot lamps in cases where the beam must be nearly horizontal because of short working distance, a small mirror may be set up on the opposite side of the subject, to throw light back into the shadowed portion of the field. The new sealed beam type of reflector flood and spot lamps are good, the chief difficulty being with the heat generated, which is really considerable with all those more than 60 watts. Photofloods and high-powered spot lamps can be used, but as a rule speed of exposure is not a criterion. If the setup is rigid, it is generally better to make longer exposures with smaller and cheaper illuminating units. Exposure times run from ½ to 5 seconds—occasionally as much as 10 to 15 seconds.

In macros of thin sections by transmitted light, the problems are the same as in regulation photomicrography. The light source must be broad enough so that the condensing lens will form an image of the light source in the camera lens, and this image must fill the lens aperture completely. This source might be a piece of opal glass or a ground glass in front of a strong bulb. Exposures in this type of photography are generally much shorter, from 1/25 to 1 second.

With all of these general suggestions in mind, the subject may be made more understandable by comment on those photomacrographs shown herewith. The housefly head, exhibiting the huge compound eyes and their multitudinous facets, presented the problem of depth of focus to a maximum degree. Here a ring illuminant was used to give a low, grazing angle of light all around; lens, a 48 mm. micro tessar.

The salt grains (sodium chloride crystals) required highlighting. They were placed on a blank slide over black paper and photographed with a 16 mm. micro tessar. Illumination was provided by a single microscope lamp, equipped with a condensing lens and a 6-v., 18-amp., ribbon filament bulb, placed at about 30° from the horizontal; exposure time, 2 seconds.

The ivy leaf, with rather flat contour, required the bringing out of texture. The illumination was from two 4-watt, blue fluorescent tubular lamps on opposite sides; one high—about 60° from horizontal—the other low, both lamps in nickel-plated trough reflectors. Lens, a 6-inch Series V Protar, *F*: 32; exposure 2 seconds on commercial ortho film; contact print.

We were much indebted, in the preparation of this article, to our regular photomicrographer, John Butterfield, whose work adds so much to each issue of *Under the Microscope*. Not only do his splendid macrographs lend point to the whole exposition, but he has also supplied notes giving most of the data, compiled from his years of experience in his professional connection with the Bausch & Lomb Optical Company in Rochester, New York. Without meaning to impute any equine characteristics to our friend John, it nevertheless may safely be said that the reader is getting his information on macrography right out of the horse's mouth.

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APPLE POLISHER

From time to time those of us who inflict introductory biological courses on an unwary bunch of new students are confronted with the task of introducing them to their microscopes. Whenever that time arrives, our suggestion is: Give your students dirty microscopes!

Sounds absurd, does it not? There is probably no better method, however, of teaching the function of optical parts as well as the necessity for and methods of keeping them clean. When the previous term closed, the microscopes were, or should have been, checked over; adjustments and repairs made or ordered, then the instruments put away. Our custom has been to store them with optical parts uncleaned, mechanical parts thoroughly cleaned. When the 'scopes are first trotted out for use by the next group of neophytes, we use the following procedure:

The students are asked to remove their microscopes from cases or cabinets and shown how to place them in correct location on the laboratory tables, with care, and at the same time a request is made that nothing whatever be done with them until instructed, step by step. Next the names of parts and their principal functions are given, each student labeling a prepared outline drawing of a generalized compound microscope. Now the lamp is introduced and correctly placed, and manipulation of the mirror, with the thumbs and forefingers of both hands acting together, demonstrated in securing uniform and moderate light. The student has been asked to place the low-power objective in the optical axis, about one-half inch above the stage, and to look through the eyepiece while adjusting the mirror and lamp. Instructors then inspect each microscope to see that the field is completely and evenly lighted with the intensity neither too dim nor too bright. The diaphragm and its operation are explained at this time. If a substage condenser is present, this may be taken up next. During these performances, there is no object on the stage and nothing is said about focusing.

A specimen slide is now given to each member of the class. This may be such a slide as we have previously discussed, composed of crossed threads of three different colors; some teachers prefer a very small letter of the alphabet, printed on onion-skin paper in six-point type. The whole mount of butterfly wing scales is good, but perhaps best of all is a stained permanent preparation of real onion skin (leaf epidermis) or section of necturus liver, as these allow some remarks about slides in general. Every student should be given a slide of the same subject, for uniformity of remarks by the teacher.

The slide is first inspected with the naked eye, brief explanations being given as to the glass slip, the cover glass, the specimen and how it is prepared, and the mounting in fluid balsam that subsequently hardens. A few remarks as to the complexity of certain techniques and the multitudinous steps in slide making will give an early idea that slides are valuable and should be treated with care, avoiding cracked covers.

Next, each student receives a piece of black photomount card, measuring some 4 x 6 inches, in the center of one end of which a puncture has been made with a fine needle: this is the well-known "pinhole card." This card is held in the left hand, as close to the left eye as possible, the student looking at the slide through the needle hole, against a strong light. He is to find that the slide, held in the right hand, can be brought to a position very close to the eye, the material being distinctly visible and magnified; the observation serving to illustrate the primary definition of magnification—that it consists in getting the eye closer to the work—obtaining a "bug's eye view."

If desired at this point, remarks as to how a biconvex lens bends light rays into a focus, increasing the visual angle, can be introduced to show that lenses magnify because they apparently bring our eye closer to the work. Then the slide is mounted under the spring clips on the microscope stage, the specimen upside down if it has oriented parts. The student is asked to look to the side while lowering the low-power objective to a point about one-quarter inch from the cover glass, then, looking down the tube, to focus slowly upward with the coarse adjustment until the subject appears in approximate focus, the image to be sharpened with the fine adjustment. It is explained that by always "focusing up" there can never be any accidents to instrument or slide in this operation.

Changing to high power, again sharpening the focus, the need for an increase in illumination, and a definition of parfocal objectives come next. Each microscope is inspected at both low and high power to see that the student clearly appreciates a sharp focus and proper illumination, then the teacher turns to the matter of cleaning the optical parts.

The student is asked to inspect the image under low power and, while doing so, to twirl the eyepiece slowly as it lies in place. Any dirt or smudge that revolves will naturally be found on this part of the microscope. If necessary, the student can make an oily fingerprint on the eyelens to bring out this point, as well as to show the necessity of avoiding such handling thereafter. The eyepiece is removed, breathed upon, and wiped immediately with lens paper or an old and soft, clean handkerchief, the performance repeated until inspection shows this surface to be free from foreign interference.

Again, while looking at the image, the slide is moved slowly back and forth; any material that moves is on the slide, and, as these are frequently soiled, the need for and methods of cleaning them in every case, just before use, can be explained. The mirror is inspected by eye and, if soiled, it is now cleaned. Finally, if foreign inclusions of any sort are still present, they are on the objective, the front lens of which is cleaned in the same manner as used for the eyepiece. The student is cautioned not to try to take objectives apart but is allowed to do so with eyepieces. If desired, this is the point at which the eyepiece diaphragm is shown and the method of inserting a hair pointer explained, with the reason why this pointer appears to lie upon the object when in use. Thereafter, each member of the class is advised to keep their instruments completely clean at all times. The days of dirty optics are over for a while.

TRADE NOTES

Laboratory Explorations in General Zoology, by Karl A. Stiles, Coe College, is one of the finest examples we have seen of the modern work-book type of science laboratory manual. The author takes a positive stand on the scientific method in a way that we have always wanted to see worked out. Instead of merely talking about this method in the usual manner, Dr. Stiles does something concrete about it. In fact, he holds that development of an appreciation and use of the scientific method and of a scientific attitude of mind is the number one objective of any introductory science course. Accordingly, after definitions, procedure, and examples of this method, it is applied throughout the manual.

Directions for work are full but without encroaching on the provinces of a textbook, and are very clear; the emphasis is physiological, with an abundance of experiments of genuine merit; each section concludes with a list of drawings to be made, demonstrations to observe, and a number of questions and problems to which the author has evidently devoted a great deal of time and thought. The more difficult drawings (e.g., frog skeleton) are provided, for labeling, and are splendidly executed; certain others are in outline only, for completion and labeling; while for still other subjects the student makes the entire drawing. Every teacher of zoology should examine this fine volume, the outgrowth of many years of experimentation in teaching the subject. Pp. x, 265, illus. The Macmillan Co., 60 Fifth Ave., New York, 1943. $2.50.